



LIBRARY  
NEW YORK  
BOTANICAL  
GARDEN









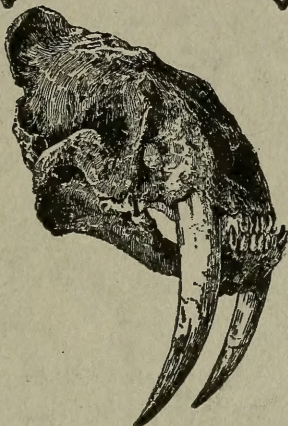




# BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

*Mostra nobiscum ipsi.*



Vol. XLII

January-April, 1943

Part 1

## CONTENTS

Page

### THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES:

- No. 14. BIRDS OF EL SEGUNDO AND PLAYA DEL REY.  
Jack C. von Bloeker, Jr. - - - 1

### CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM— CHANNEL ISLANDS BIOLOGICAL SURVEY

- No. 28. THREE NEW PLANTS FROM SAN CLEMENTE ISLAND—  
M. B. Dunkle - - - 31

### NOTES ON CALIFORNIA SPIDERS

- No. 3. ON THE LIFE HISTORY AND PROGRESSIVE FACTOR IN  
GROWTH OF *TEUTANA GROSSA*.—J. H. Branch - - - 34

### HENRICUS, A NEW NAME FOR A PHALONIID GENUS—

- August Busck - - - 38

### WESTERN POPLAR SPHINX—

- John A. Comstock and Charles M. Dammers - - - 39

### CALIFORNIA SPECIES OF *SMERINTHUS* WITH NOTES ON THE EARLY STAGES OF *S. CERISYI* *OPHTHALMICUS*—

- John A. Comstock and Charles M. Dammers - - - 42

### THE LARVA OF *COPICUCULLIA BASIPUNCTA* B. & McD.—

- John A. Comstock and Christopher Henne - - - 45

### POLITES SONORA SIRIS EDW. RAISED FROM THE SYNONYMY—

- Lloyd M. Martin - - - 46

### A NEW SUBSPECIES OF *ORCHOPEAS SEXDENTATUS*—

- G. F. Augustson - - - 49

### A NEW PARASITIC FLY FROM BATS—G. F. Augustson - - - 52



XB  
u8835  
vol. 42-43  
1943-44

# Southern California Academy of Sciences



## OFFICERS and DIRECTORS

DR. R. H. SWIFT - - - - - *President*  
DR. H. J. ANDREWS - - - - - *First Vice-President*  
DR. W. DWIGHT PIERCE - - - - - *Second Vice-President*  
DR. JOHN A. COMSTOCK - - - - - *Secretary and Treasurer*

DR. H. J. ANDREWS	DR. HOWARD R. HILL
DR. A. WIER BELL	MR. THEODORE PAYNE
MR. FRED E. BURLEW	DR. W. DWIGHT PIERCE
DR. JOHN A. COMSTOCK	DR. R. H. SWIFT
MR. SAMUEL MOODY HASKINS	MR. R. S. WOGLUM



## ADVISORY BOARD

DR. CHESTER STOCK                      DR. ROBERT L. RUTHERFORD  
DR. WILLIAM L. LLOYD



## BOTANICAL SECTION

MR. THEODORE PAYNE, *Secretary*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT

## FINANCE COMMITTEE

MR. SAMUEL MOODY HASKINS

## PROGRAM COMMITTEE

DR. HOWARD R. HILL, *Chairman*                      DR. JOHN A. COMSTOCK



## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK



## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles, Calif.

## Bulletin, Southern California Academy of Sciences

VOLUME 42 - - - - - PART 1, 1943

THE FAUNA AND FLORA OF  
THE EL SEGUNDO SAND DUNES

## 14. BIRDS OF EL SEGUNDO AND PLAYA DEL REY

By JACK C. VON BLOEKER, JR.  
ALLAN HANCOCK FOUNDATION  
University of Southern California

The area covered in the present report includes El Segundo beach and sand dunes, Playa del Rey beach and salt marsh, and that portion of the Pacific Ocean, within a mile or so of shore, bordering on the Playa del Rey—El Segundo region. Because the ocean and salt marsh play such important roles in governing the occurrence of a large proportion of the bird life of El Segundo sand dunes, it was deemed best to include them in the survey of the avifauna.

In preparing this paper, the objectives I have attempted to keep in mind have been to assemble and present information that would indicate: (1) the species and subspecies of birds occurring within the region, (2) the relative abundance and distribution of these forms within the area, (3) the factors determining the presence and habitat distribution of the various kinds, and (4) the annual cycle of activity of each kind in the region.

The relative completeness of the present list is due, not so much to the observations of members of the El Segundo Sand Dunes Survey group as, to the fortunate circumstance that, in the early part of this century and up to 1923, members of the Southern Division of the Cooper Ornithological Club did a large amount of field work in this area. Their specimens, many of them deposited in the Los Angeles Museum, constitute an extremely valuable source of information on the birds of this territory, particularly as regards forms which are not readily identifiable in the field. Among the men who did the greater part of this early field work are included: Dr. Louis B. Bishop, W. Lee Chambers, Frank S. Daggett, Dr. Joseph Grinnell, Dr. John



Hornung, Antonin Jay, Dr. Loye H. Miller, George Willett, and Luther E. Wyman. Primarily, their work was with water birds and, it was so thorough that I devoted the majority of my time in the area to making observations on, and collecting, land birds, mammals, amphibians and reptiles.

To some it may seem that the present list is unnecessary and superfluous, as Grinnell's list of the birds of the Pacific slope of Los Angeles County was published in 1898 and, more recently, Willett's list of the birds of southwestern California appeared in 1912 and, in revised form, in 1933. Little, if any, is added in the way of general information, especially in regard to the water birds, to the value of Willett's 1933 list. The latter paper, however, is much broader in scope than the present one in treating the distribution of species and in area covered, and it is more concerned with problems of taxonomy than is this one. On the other hand, it deals with ecology only in a very general sense and, furthermore, it is not always available to those who are particularly interested in the fauna and flora of the Playa del Rey—El Segundo region. Therefore, for the benefit of those who do not have access to Pacific Coast Avifauna No. 21, and in order to add to the completeness of the series of papers covering this survey, I have consented to prepare this list at the request of Dr. W. Dwight Pierce, leader of the El Segundo Sand Dunes Survey group.

### Acknowledgments

It is a pleasure to acknowledge assistance in connection with the preparation of this report. I am deeply indebted to George Willett for helpful criticisms and valuable suggestions, and for permission to refer to the specimens in the collections in his charge at the Los Angeles County Museum. To Dr. Catherine V. Beers, Professor of Ornithology and Genetics, University of Southern California, I owe thanks for reading and correcting the first draft of this paper. Much credit is due to Dr. John A. Comstock for advice given in his editorial capacity and otherwise, and to him and the Southern California Academy of Sciences I am thankful for reproducing the results of the study in published form.

To the following persons I wish to express my sincere appreciation for their assistance in the field and in reporting observations: Granville P. Ashcraft, Gus F. Augustson, George G. Cantwell, Ronald H. Coombs, Frances L. Cramer, Mrs. E. H. Crane, Chris Henne III, J. Ernest Lewis, Lloyd M. Martin, Dr. W. Dwight Pierce, Mrs. Dorothy Pool, Dr. Robert L. Rutherford, James O. Stevenson, Bonnie Templeton, and Paul E. Trapier.

### Habitat Divisions

The large assemblage of birds of the Playa del Rey-El Segundo region occurs there as the result of various circumstances. Some are hatched and mature there; certain forms may live within its boundaries for a number of successive generations without ever leaving the area. The latter, of course, are those sedentary species which either have relatively poor powers of flight or apparently have neither initiative nor reason to migrate away. For them all the necessary requirements for existence are present within a relatively small radius from their place of coming into being and outside of which they find no attraction to draw them away. Nearly one-fifth, or 18.3 per cent, of the number of kinds of birds in this region belong in this category, i.e., the breeding residents.

In addition to the breeding resident birds in the area, we recognize several other groups, as regards occurrence. These are: non-breeding residents (present throughout all seasons, but nesting elsewhere); summer residents (nesting here and wintering elsewhere); summer visitants (present in summer, but nesting outside the area); winter visitants (breeding elsewhere, wintering here); migrants (passing through the region in spring or fall, usually both); and irregular visitants (including accidentals, vagrants, occasionals, and transient pioneers). Non-breeding residents comprise about one-ninth, or 11.4 per cent; summer residents, one-twenty-sixth, or 3.8 per cent; summer visitants, one-forty-sixth, or 2.2 per cent; winter visitants, a little over one-third, or 34.1 per cent; spring and fall migrants, about one-sixth, or 15.6 per cent; and irregular visitants, one-seventh, or 14.6 per cent of the total of avian species and subspecies known to occur within the region covered by this survey.

It must be remembered of course, that the figures given above do not in any manner apply to the comparative abundance of individuals in each category. Figures of the latter sort would be impossible to achieve, for it would obviously be utterly impracticable to attempt to procure an accurate record of the numbers of individuals representing each species and race in an area such as the one under consideration. Also, as time passes and additional changes come, so, inevitably, will changes be effected in the relative proportions of avian kinds represented. Forms of irregular occurrence may become more regular; they may acquire seasonal status or even become resident. Many others undoubtedly will find the area less hospitable and become increasingly rarer, more irregular in occurrence, or entirely driven out. In other words, the data as here presented can only be held accountable for what is known up to the present time (May, 1942)—not for the unpredictable facts of the future.



It is the geographic position of a region which largely determines what kinds of life may venture into it, but whether each individual remains after its arrival depends upon the conditions prevailing at that time. These conditions involve both internal factors in the individuals and external factors of the environment. It is not my purpose here to discuss further the internal factors beyond indicating that they merit recognition. Thus, the following analysis is concerned with the features of the Playa del Rey - El Segundo region which render it habitable by birds.

As outlined above in the introduction, the area selected for the purpose of this study may well be regarded as an environmental unit in which each life form found there has chosen, or may be confined to, the specific set of conditions to which it is adapted or those which it can at least exist in. However, because in theory each kind of living form would of necessity require conditions which differ to a greater or lesser degree from those suitable to any other kind, it is obviously better to simplify the discussion of this phase of the survey. Therefore, as a means to this end and in order to clarify the relationships to be analyzed, certain associations are here recognized and defined. Botanists and entomologists have found it useful to make a finer analysis (for example, see Pierce and Pool, 1938). A more detailed study of the birds in this area might similarly warrant greater subdivision.

The five habitat divisions here regarded as sufficient for the purposes of the present study are as follows:

*Ocean*—that portion of Santa Monica Bay which forms the western boundary of the Playa del Rey - El Segundo region and extending for a mile or two, but within sight, from the shore.

*Ocean shore*—represented by barren sandy beach, embryonic dunes, and occasional cliff-like headlands, or palisades.

*Sand dunes*—including brush-covered areas, moving dunes, and grassy meadows and basins.

*Meadow*—represented by grassland, stubble-fields, and low growth brushland, and protected from direct exposure to the ocean by the sand dunes.

*Salt marsh*—as characterized by a dominant growth of pickleweed (*Salicornia*) and certain outstanding features of topography such as nearly flat land (a large part of which may be flooded at high tide), numerous tidal sloughs and a brackish water lagoon. Within this habitat may well be recognized two or more important subdivisions as: a fresh water creek draining into the marsh and with side branches bordered in certain sections by growths of tules and cat-tails, and in others by willow thickets.

In the lists of species for each association, all birds found there are included with the exception of a few of such rare occurrence as to exclude them from consideration in the present connection. This especially refers to those known from single, or just a few, records. Qualifying terms are given in each case as to exclusive (excl.), maximum (max.), or minor (min.) occurrence. Naturally, a species marked *exclusive* will be found in only one of the lists while one indicated as of *maximum* occurrence will be found listed as *minor* in one or more of the others. Due to the uncertainty necessarily attendant in certain instances, or where doubt exists as a result of paucity of data, a question mark is added. Seasonal occurrence is indicated as follows: breeding resident (R.); non-breeding resident, here recognized as a *guest* species (G.); summer resident, breeding within the confines of the habitat (SR.); summer visitant (SV.); winter visitant (W.); transient, or spring and fall migrant (T.). Summer and winter birds often may be present in spring and fall also. Qualifying and seasonal terms in the associational lists apply to the occurrence of the species within the habitat for which they are listed only, not to the Playa del Rey - El Segundo region as a whole. For example, a species may be listed as a breeding resident in one habitat, a non-breeding resident in another; or a winter visitant in one and a breeding resident in another.

## BIRDS OF THE OCEAN

- Gavia immer*: excl.; W.  
*Gavia arctica pacifica*: excl.; W.  
*Gavia stellata*: excl.; W.  
*Colymbus auritus*: excl.?.; W.  
*Colymbus nigricollis californicus*: max.?.; W.  
*Aechmophorus occidentalis*: max.?.; W.  
*Podilymbus podiceps podiceps*: min.; W.  
*Puffinus tenuirostris*: excl.; W. (irregular)  
*Puffinus griseus*: excl.; G.  
*Puffinus opisthomelas*: excl.; W.  
*Puffinus creatopus*: excl.; SV.  
*Fulmarus glacialis rogersi*: max.; W. (irregular)  
*Oceanodroma melania*: excl.; G.  
*Oceanodroma homochroa*: excl.; SV.?  
*Pelecanus occidentalis occidentalis*: max.; G.  
*Phalacrocorax auritus albociliatus*: max., G.  
*Phalacrocorax penicillatus*: max.; G.  
*Phalacrocorax pelagicus resplendens*: max.; W. (irregular)  
*Mareca americana*: min.; W.  
*Nyroca affinis*: min.; W.  
*Melanitta deglandi*: excl.; W.  
*Melanitta perspicillata*: excl.; W.



*Oidemia americana*: excl.; W. (rare)  
*Mergus merganser americanus*: min.; W.  
*Mergus serrator*: min.; W.  
*Erismatura jamaicensis rubida*: min.; W.  
*Fulica americana americana*: min.; G.  
*Phalaropus fulicarius*: max.; T.  
*Steganopus tricolor*: max.?.; T.  
*Lobipes lobatus*: max.?.; T.  
*Stercorarius parasiticus*: excl.; T., and W. (rare)  
*Larus hyperboreus*: max.; W.  
*Larus glaucescens*: max.; W., and SV. (rare)  
*Larus occidentalis wymani*: max.; G.  
*Larus argentatus smithsonianus*: max.; W.  
*Larus argentatus thayeri*: max.; W. (occasional and rare)  
*Larus californicus*: min.; W.  
*Larus delawarensis*: min. W.  
*Larus canus brachyrhynchus*: max.; W.  
*Larus pipixcan*: excl.?.; T. (rare)  
*Larus philadelphia*: min.; W.  
*Larus heermanni*: max.; G.  
*Rissa tridactyla pollicaris*: excl.?.; W. (rare)  
*Xema sabinii*: excl.?.; T.  
*Sterna forsteri*: min.; W.  
*Sterna hirundo hirundo*: max.; T.  
*Sterna antillarum*: max.; SV.  
*Sterna maxima maxima*: max., W. (occasional)  
*Sterna elegans*: excl.?.; T. (irregular)  
*Sterna caspia*: max.; W., and SV. (occasional)  
*Chlidonias nigra surinamensis*: max.?.; T.  
*Synthliboramphus antiquus*: excl.; W.  
*Ptychoramphus aleuticus*: excl.; G.  
*Cerorhinca monocerata*: excl.; W.  
*Megaceryle alcyon caurina*: min.; G.

*Remarks:* In the above list of species, no account is taken of land birds and certain wading birds which may occasionally fly over the ocean in this area. The list is intended to include only those forms which find conditions suitable for foraging, for resting and for safety there, and those which more or less regularly and exclusively pass over Santa Monica Bay in their normal migrations through this region.

The main attraction, in the way of food supply, in this habitat consists chiefly of fish, which sporadically abound in the waters of Santa Monica Bay. The sewage disposal plant, which empties into the ocean at Hyperion, undoubtedly also serves as an attraction for the large assemblage of scavenger types—in particular, the gulls.

## Birds of the Shore

- Fulmarus glacialis rodgersi*: min.; W. (irregular)  
*Pelecanus occidentalis californicus*: min.; G.  
*Phalacrocorax auritus albociliatus*: min.; G.  
*Phalacrocorax penicillatus*: min.; G.  
*Phalacrocorax pelagicus resplendens*: min.; W. (irregular)  
*Ardea herodias hyperonca*: min.; G.  
*Mergus merganser americanus*: min.; W.  
*Mergus serrator*: min.; W.  
*Fulica americana americana*: min.; G.  
*Charadrius nivosus nivosus*: excl. ?; R.  
*Charadrius semipalmatus*: excl. ?; T.  
*Oxyechus vociferus vociferus*: min.; G.  
*Squatarola squatarola*: min.; T., and W. (occasional)  
*Arenaria melanocephala*: excl.; G.  
*Numenius americanus americanus*: min.; W.  
*Numenius americanus parvus*: min.; W.  
*Phaeopus hudsonicus*: min.; T., and W. (occasional)  
*Catoptrophorus semipalmatus inornatus*: max.; T.; and min.; W. and SV.  
*Totanus melanoleucus*: min.; T., and W. and SV. (occasional)  
*Totanus flavipes*: min.; T. (rare)  
*Calidris canutus rufus*: min.; T.  
*Pisobia melanotos*: min. ?; T. (rare)  
*Pisobia bairdii*: excl. ?; T. (rare)  
*Pisobia minutilla*: min.; W.  
*Pelidna alpina sakhalina*: max. ?; T., and W. (occasional)  
*Limnodromus griseus griseus*: min.; T., and W. (occasional)  
*Limnodromus griseus scolopaceus*: min.; T. and G.  
*Ereunetes mauri*: min.; T. and G.  
*Limosa fedoa*: min.; T. and W.  
*Crocethia alba*: excl. ?; W., and SV. (occasional)  
*Recurvirostra americana*: min.; T., and W. (rare)  
*Himantopus mexicanus*: min.; W. (rare), and SV. (occasional)  
*Larus hyperboreus*: min.; W. (occasional)  
*Larus glaucescens*: min.; W., and S.V. (rare)  
*Larus occidentalis wymani*: min.; G.  
*Larus argentatus smithsonianus*: min.; W.  
*Larus argentatus thayeri*: min.; W. (rare)  
*Larus californicus*: min.; W.  
*Larus delawarensis*: min.; W.  
*Larus canus brachyrhynchus*: min.; W.  
*Larus philadelphia*: min.; W.  
*Larus heermanni*: min.; G.  
*Sterna antillarum*: min.; SR.



*Megasceryle alcyon caurina*: min.; G. (=R.?)  
*Sayornis saya saya*: min.; W. (occasional)  
*Corvus corax sinuatus*: min.; G. (occasional)  
*Salpinctes obsoletus obsoletus*: max.; R.  
*Dendroica audobonii audubonii*: min.; W.  
*Euphagus cyanocephalus*: min.; G.  
*Carpodacus mexicanus frontalis*: min.; R.  
*Passerculus sandwichensis beldingi*: min.; G.  
*Passerculus sandwichensis rostratus*: min.; W.

*Remarks:* All of the area which has been directly affected by action of the ocean waves within comparatively recent times (i.e., within the past forty to fifty years) is here considered as shore. In the Playa del Rey - El Segundo region it comprises the beach below high tide; the sandy strand; the clay embankment, or permanent shoreline, including bluffs, palisades, and remnant outcrops; and man-made piers running from the land out into the surf. As may be concluded from this list and the preceding one, the ocean, plus the wave-formed shore, is responsible for the occurrence of a large proportion of the avifauna in this region.

In general, the shore serves as a resting and foraging ground for shore-birds (including gulls) and a few land birds. But three species are definitely known to nest here to the exclusion of the other habitats. These are the Snowy Plover and Least Tern on the strand and the Rock Wren in crevices of the palisades and protected parts of the clay embankment. The House Finch also nests in suitable places in the palisades, but not exclusively so. It is possible that the Belted Kingfisher, too, may nest in the palisades at Playa del Rey, but this is not positively known.

Some birds, not included in the list of shore-inhabiting forms because they are at present known only from single records, would undoubtedly be more abundant here if conditions were more suitable. For example if there were large rocks and rocky promontories jutting into the surf, unquestionably one would find such species as the surf-bird, turnstones, spotted sandpiper, and tattler more commonly here. In other words, the absence of conditions of just the right kind precludes the possibility of their remaining here for any length of time after they have once arrived. Furthermore, I venture to say that, if conditions were right for these latter mentioned types, one would also be able to add to the list such forms as oyster-catchers and the solitary sandpiper which, to my knowledge, have as yet never been seen in this immediate area.

## Birds of the Sand Dunes

- Cathartes aura septentrionalis*: max.; G.  
*Buteo borealis calurus*: max.; G.  
*Haliaeetus leucocephalus leucocephalus*: max.; G. (rare)  
*Circus hudsonius*: min.; G.  
*Falco sparverius sparverius*: min.; R.  
*Lophortyx californica californica*: min.; R.  
*Oxyechus vociferus vociferus*: min.; G.  
*Zenaidura macroura marginella*: min.; G. (=R.?)  
*Geococcyx californianus*: min.; R.  
*Tyto alba pratincola*: min.; G.  
*Speotyto cunicularia hypugaea*: max.?.; R.  
*Aëronautes saxatilis saxatilis*: max.; W.  
*Calypte anna*: max.; R.  
*Selasphorus rufus*: max.; T.  
*Selasphorus alleni alleni*: max.; T.  
*Colaptes cafer collaris*: min.; G.  
*Tyrannus verticalis*: min.; SV. (=SR.?)  
*Sayornis nigricans nigricans*: max.; R.  
*Sayornis saya saya*: min.; W.  
*Otocoris alpestris actia*: min.; R.  
*Stelgidopteryx ruficollis serripennis*: min.; T. (irregular)  
*Hirundo erythrogaster*: min.; T.  
*Petrochelidon albifrons albifrons*: min.; SR.  
*Corvus corax sinuatus*: min.; G.  
*Psaltiriparus minimus minimus*: max.; R.  
*Chamaea fasciata henshawi*: max.; R.  
*Troglodytes aëdon parkmani*: max.; SR., and W. (occasional)  
*Thryomanes bewickii correctus*: max.; W.  
*Telmatodytes palustris paludicola*: min.; W.  
*Salpinctes obsoletus obsoletus*: min.; G. (occasional)  
*Mimus polyglottos leucopterus*: max.; R.  
*Toxostoma redivivum redivivum*: excel.; W.  
*Turdus migratorius propinquus*: max.; W. (irregular)  
*Hylocichla guttata guttata*: max.; W.  
*Sialia mexicana occidentalis*: min.; W. (irregular)  
*Myadestes townsendi*: excl.?.; W. (rare)  
*Polioptilia caerulea amoenissima*: max.; W.  
*Corthylia calendula cinerascens*: min.; W.  
*Anthus spinoletta rubescens*: min.; W.  
*Lanius ludovicianus gambeli*: min.; R.  
*Vireo huttoni huttoni*: min.; W.  
*Vermivora celata lutescens*: min.; T.  
*Vermivora celata sordida*: max.; W.  
*Dendroica audubonii audubonii*: min.; W.  
*Dendroica townsendi*: max.; T.  
*Passer domesticus domesticus*: min.; R.



*Icterus cucullatus nelsoni*: min.; T.  
*Icterus bullockii*: min.; SV.  
*Euphagus cyanocephalus*: min.; R.  
*Piranga ludoviciana*: min.; T.  
*Carpodacus mexicanus frontalis*: max.; R.  
*Spinus tristis salicamans*: min.; G.  
*Spinus psaltria hesperophilus*: min.; W.  
*Pipilo fuscus crissalis*: max.; R.  
*Passerculus sandwichensis alaudinus*: min.; W.  
*Passerculus sandwichensis rostratus*: min.; W.  
*Zonotrichia leucophrys gambelii*: min.; W.  
*Zonotrichia coronata*: max.; W.  
*Melospiza melodia cooperi*: min.; R.

*Remarks:* As with the list of the birds of the ocean, no account is taken in the present one of those species which may be seen flying over the dunes (except those definitely known to be foraging), on the way to or from feeding grounds beyond the limit of this habitat.

The sand dunes of El Segundo constitute an important habitat for birds. Within the area may be found a variety of situations suitable as forage grounds, nesting sites, and cover, for many species. In certain portions, which have been modified through construction of human dwellings and with subsequent establishment of gardens and the introduction of ornamental trees, the habitat has become more attractive to some birds which might not otherwise occur there, or at least be less in evidence than at present. The seaward slope of the dunes, exposed to the prevailing winds from the ocean, seems generally less attractive to most forms than do the protected ravines and basins and the landward slope of the dunes. However, in many places on the seaward slope, protection from the wind is effected by dense growths of brush and in these birds are usually quite common. For the most part, everywhere that brushy vegetation grows in the Playa del Rey - El Segundo region bird-life is prolific. It is most frequented, of course, by those forms which have limited powers of flight and, hence, depend upon closely adjacent cover in which to escape their enemies. At least seventeen species of birds are positively known to nest on the dunes, but only three do so to the exclusion of the two remaining habitats to be discussed.

#### Birds of the Meadow

*Ardea herodias hyperonca*: min.; G.  
*Cathartes aura septentrionalis*: min.; G.  
*Accipiter velox velox*: excl.; W.  
*Accipiter cooperii*: excl.?.; G.?

- Buteo borealis calurus*: min.; R.  
*Circus hudsonicus*: min.; G.  
*Falco sparverius sparverius*: max.; R.  
*Lophortyx californica californica*: max.; R.  
*Oxyechus vociferus vociferus*: min.; R.  
*Larus californicus*: min.; G.  
*Larus delawarensis*: min.; G.  
*Zenaidura macroura marginella*: max.; R.  
*Geococcyx californianus*: max.; R.  
*Tyto alba pratincola*: max.; R.  
*Speotyto cunicularia hypugaea*: min. ?; R.  
*Asio flammeus flammeus*: min.; W. (occasional)  
*Aëronautus saxatilis saxatilis*: min.; W.  
*Archilochus alexandri*: max.; T.  
*Calypte anna*: min.; R.  
*Selasphorus rufus*: min.; T.  
*Selasphorus alleni alleni*: min.; T.  
*Colaptes cafer collaris*: max.; R.  
*Tyrannus verticalis*: max.; SR.  
*Sayornis nigricans nigricans*: min.; R.  
*Sayornis saya saya*: max.; W.  
*Otocoris alpestris actia*: max.; R.  
*Hirundo erythrogaster*: min.; T.  
*Petrochelidon albifrons albifrons*: min.; SV.  
*Corvus corax sinuatus*: min.; G.  
*Corvus brachyrhynchos hesperis*: excl. ?; G.  
*Chamaea fasciata henshawi*: min.; G. (=R. ?)  
*Troglodytes aëdon parkmani*: min.; R.  
*Thryomanes bewickii correctus*: min.; W.  
*Telmatodytes palustris paludicola*: min.; W.  
*Mimus polyglottos leucopterus*: min.; R.  
*Turdus migratorius propinquus*: min.; W. (irregular)  
*Hylocichla guttata guttata*: min.; W.  
*Sialia mexicana occidentalis*: max.; W. (irregular)  
*Polioptilia caerulea amoenissima*: min.; W.  
*Corthylus calendula cinerascens*: min.; W.  
*Anthus spinoletta rubescens*: max.; W.  
*Lanius ludovicianus gambeli*: max.; R.  
*Vermivora celata sordida*: min.; W.  
*Dendroica audubonii audubonii*: min.; W.  
*Dendroica townsendi*: min.; W.  
*Geothlypis trichas scirpicola*: min.; W.  
*Passer domesticus domesticus*: max.; R.  
*Sturnella neglecta*: max.; R.  
*Agelaius phoeniceus neutralis*: min.; G.  
*Icterus cucullatus nelsoni*: min.; T.  
*Icterus bullockii*: min.; SV.



*Euphagus cyanocephalus*: max.; R.  
*Piranga ludoviciana*: min.; T.  
*Hedymeles melanocephalus*: min.; T.  
*Carpodacus mexicanus frontalis*: min.; R.  
*Spinus tristis salicamans*: min.; G.  
*Spinus psaltria hesperophilus*: min.; W.  
*Pipilo fuscus crissalis*: min.; G.  
*Passerculus sandwichensis alaudinus*: max.; W.  
*Zonotrichia leucophrys gambelii*: max.; W.  
*Zonotrichia coronata*: min.; W.  
*Melospiza lincolni lincolni*: min.; W.  
*Melospiza melodia cooperi*: min.; G.

*Remarks:* The meadow area also forms an important habitat division for birds of the Playa del Rey - El Segundo region. A large part of the meadow is covered throughout the year by low-growth vegetation, such as grass, weeds, and non-native plants. Part of it is at times under cultivation, being utilized for the production of grain. Another section is heavily over-grown with native shrubs. In the northern and southeastern portions are situated human habitations with the usual accompanying gardens and ornamental trees. The western boundary is formed by the irregular outline of the base of the encroaching sand dunes, which afford a large measure of protection from oceanic winds. Toward the east there is in general a gentle but pronounced sloping upward of the ground, so that the lowest level of the meadow is at the eastern base of the dunes.

In the grassland (including the areas of native and non-native grasses and weeds, and the grain-fields), an abundance of forage is provided for granivorous and insectivorous birds. Also, because of a large population of burrowing mammals there, raptorial species find it a profitable place in which to hunt.

In the brushy portion are found species of the same general types and kinds as those in the brushland of the dunes. However, they usually are not so abundant in the meadow as on the dunes. Species attracted to the type of conditions prevailing in the vicinity of human dwellings on the dunes are similarly found in like situations in the meadow area.

Eighteen species of birds are definitely known to find conditions suitable for nesting in the general meadow area, but only two of these do so to the exclusion of all other habitats in the region as a whole.

## Birds of the Salt Marsh

- Colymbus nigricollis californicus*: min.?; W.  
*Aechmophorus occidentalis*: min.?; W.  
*Podilymbus podiceps podiceps*: max.; W.  
*Pelecanus occidentalis californicus*: min.; G.  
*Phalacrocorax auritus albociliatus*: min.; G.  
*Ardea herodias hyperonca*: max.; G.  
*Casmerodius albus egretta*: excl.; G. (irregular)  
*Egretta thula brewsteri*: excl.; G. (rare)  
*Butorides virescens anthonyi*: excl.; T. (occasional)  
*Nycticorax nycticorax hoactli*: excl.; G.  
*Botaurus lentiginosus*: excl.; W.  
*Ixobrychus exilis hesperis*: excl.; SV. (=SR.?)  
*Plegadis guarana*: excl.; W. (irregular)  
*Anas platyrhynchos platyrhynchos*: excl.; W. (occasional)  
*Mareca americana*: max.; W.  
*Dafila acuta*: excl.; W., and R. (rare)  
*Querquedula cyanopectera*: excl.; T., and SR. (occasional)  
*Nyroca americana*: excl.; W.  
*Nyroca valisneria*: excl.; W.  
*Nyroca affinis*: max.; W.  
*Glaucionetta clangula americana*: excl.?; W. (occasional)  
*Charitonetta albeola*: excl.; W.  
*Erismatura jamaicensis rubida*: max.; W.  
*Lophodytes cucullatus*: excl.; W. (rare)  
*Mergus merganser americanus*: max.; W.  
*Mergus serrator*: max.; W., and SV. (irregular)  
*Haliaeetus leucocephalus leucocephalus*: min.; G. (rare)  
*Circus hudsonius*: max.; R.  
*Falco sparverius sparverius*: min.; G.  
*Rallus obsoletus levipes*: excl.; R.  
*Rallus limicola limicola*: excl.; R.  
*Porzana carolina*: excl.; R.  
*Creciscus jamaicensis coturniculus*: excl.; R. (rare?)  
*Fulica americana americana*: max.; R.  
*Oxyechus vociferus vociferus*: max.; R.  
*Squatarola squatarola*: max.; T.; and W. (occasional)  
*Numenius americanus americanus*: max.; W.  
*Numenius americanus parvus*: max.; W.  
*Phaeopus hudsonicus*: max.; T.; and W. (occasional)  
*Catoptrophorus semipalmatus inornatus*: min. T.; and max.; W. and SV.  
*Totanus melanoleucus*: max.; T.; and W. and SV. (occasional)  
*Totanus flavipes*: max.; T. (rare)  
*Calidris canutus rufus*: max.; T.  
*Pisobia melanotos*: max.?; T. (rare)  
*Pisobia minutilla*: max.; W.



- Limnodromus griseus griseus*: max.; T., and W. (occasional)  
*Limnodromus griseus scolopaceus*: max.; T. and G.  
*Ereunetes mauri*: max.; T. and G.  
*Limosa fedoa*: max.; T.; W. and SV. (rare)  
*Recurvirostra americana*: max.; T.; and W. (rare)  
*Himantopus mexicanus*: max.; SR. and W. (rare)  
*Phalaropus fulicarius*: min.; T.; and W. (occasional)  
*Steganopus tricolor*: min. ?; T.  
*Lobipes lobatus*: min.; T.  
*Larus occidentalis wymani*: min.; G.  
*Larus californicus*: max.; W.  
*Larus delawarensis*: max.; W.  
*Larus philadelphia*: max.; W.  
*Sterna forsteri*: max.; W.  
*Sterna hirundo hirundo*: min.; T.  
*Sterna antillarum*: min.; SV.  
*Sterna maxima maxima*: min.; W. (occasional)  
*Sterna caspia*: min.; W. and SV. (occasional)  
*Chlidonias nigra surinamensis*: min. ?; T.  
*Tyto alba pratincola*: min.; R.  
*Speotyto cunicularia hypugaea*: min.; R.  
*Asio flammeus flammeus*: max.; W. (irregular)  
*Aëronautas saxatilis saxatilis*: min.; W.  
*Archilochus alexandri*: min.; T.  
*Calypte anna*: min.; G.  
*Megasceryle alcyon caurina*: max.; G.  
*Colaptes cafer collaris*: min.; R.  
*Tyrannus verticalis*: min.; SR.  
*Sayornis nigricans nigricans*: min.; R.  
*Sayornis saya saya*: min.; W.  
*Otocoris alpestris actia*: min.; G.  
*Stelgidopteryx ruficollis serripennis*: max.; T. (irregular)  
*Hirundo erythrogaster*: max.; T.  
*Petrochelidon albifrons albifrons*: max.; SR.  
*Psaltiriparus minimus minimus*: min.; R.  
*Thryomanes bewickii correctus*: min.; W.  
*Telmatodytes palustris plesius*: excl.; T. and W.  
*Telmatodytes palustris paludicola*: max.; R.  
*Corthylio calendula cinerascens*: max.; W.  
*Anthus spinoletta rubescens*: min.; W.  
*Lanius ludovicianus gambeli*: min.; G.  
*Vireo huttoni huttoni*: max.; W.  
*Vermivora celata lutescens*: max.; T.; and W. (occasional)  
*Vermivora celata sordida*: min.; W.  
*Dendroica audubonii audubonii*: max.; W.  
*Dendroica townsendi*: min.; W.  
*Geothlypis trichas scirpicola*: max.; R.  
*Sturnella neglecta*: min.; G.

*Agelaius phoeniceus neutralis*: max.; R.  
*Icterus cucullatus nelsoni*: max.; T.  
*Icterus bullockii*: max.; SR.  
*Euphagus cyanocephalus*: min.; G.  
*Piranga ludoviciana*: max.; T.  
*Hedymeles melanocephalus*: max.; SR.  
*Carpodacus mexicanus frontalis*: min.; R.  
*Spinus tristis salicamans*: max.; R.  
*Spinus psaltria hesperophilus*: max.; W.  
*Passerculus sandwichensis alaudinus*: min.; W.  
*Passerculus sandwichensis beldingi*: max.; R.  
*Passerculus sandwichensis rostratus*: max.; W.  
*Zonotrichia leucophrys gambelii*: min.; W.  
*Zonotrichia coronata*: min.; W.  
*Melospiza lincolnii lincolnii*: max.; W.  
*Melospiza melodia cooperi*: max.; R.

*Remarks:* From the length of the list of birds occurring within the salt marsh, it appears conclusive that in general this habitat is the most attractive to the avifauna of the Playa del Rey - El Segundo region. Of course, it must be recognized that there are at least four distinguishable subdivisions within the major habitat, each of which could be segregated for separate discussion. They are: (1) the brackish water lagoon and tidal sloughs; (2) the tule-bordered ponds and creeks; (3) the willow bottoms of Ballona Creek; and (4) the large expanses of tidal mud flats covered for the most part with pickle-weed (*Salicornia*).

The first of these subdivisions serves as an attraction for the many water birds: the grebes, pelican, cormorant, larger herons, ibis, ducks, shore-birds, gulls, and terns. The second is the natural habitat of the smaller herons, the sora rail and coot, the marsh wrens, the yellowthroat, the redwing, and the song sparrow. The third constitutes an important foraging-place and cover for many of the small land birds wintering there and, in addition, nesting sites for the barn owl, flicker, kingbird, bullock oriole, grosbeak, linnet, and willow goldfinch. The fourth is the optimum habitat for three of the four rails, the marsh sparrows, and a few others.

Some of the birds included in the salt marsh list actually are found only on the periphery of this habitat. There certain tree-like plants, such as tree tobacco and castor-bean, grow particularly well and form an especial attraction to certain birds. In this group are included the hummingbirds, most of the warblers, and some of the sparrows.



Found throughout all, or nearly all, of the salt marsh area and thus serving to link the separate divisions together are the hawks, owls, killdeer, black phoebe, and song sparrow. Others, too, overlap in their ranges from one into another of the several subdivisions. Consequently, for the purpose of this study it seems best to consider the salt marsh as a habitat unit, with reservations as described above.

#### ACCOUNTS OF SPECIES

The following accounts take into consideration every species and subspecies of bird which has been reported on reliable authority as occurring within the Playa del Rey - El Segundo region. Most of the identifications are backed by actual specimens. The classification follows that of Willett, 1933.

Records of specimens from this area which have been examined by the writer are here included and, unless otherwise stated, they are in the collection of the Los Angeles Museum. In so far as possible, reference is made to the areal distribution and relative abundance of each avian species found in the region, known dates of arrival and departure of migratory birds; and extent of the breeding season for those kinds which are known to nest there.

### Class AVES—Birds

#### Subclass Neornithes—Modern Birds

#### Order GAVIIFORMES—Loons

##### Family Gaviidae—Loons

##### *Gavia immer* (Brünnich). Common Loon

A common winter visitant off-shore from late October to early May. Has been seen off adjacent Manhattan Beach as late as July 6 (Willett, 1912, p. 10; 1933, p. 11). Two specimens taken at Hyperion by Wyman, Nov. 5, 1917, and Jan. 10, 1919.

##### *Gavia arctica pacifica* (Lawrence). Pacific Loon

Common off-shore winter visitant from late September to late May. Two specimens taken at Hyperion Apr. 17, and May 11, 1916, by Wyman, and two from same locality in Willett Collection taken Nov. 27, 1918, by Willett.

##### *Gavia stellata* (Pontoppidan). Red-throated Loon

Common winter visitant off-shore from late September to late April. Ten specimens taken at Hyperion by Jay, Willett, and Wyman: earliest, Dec. 18; latest, Mar. 9.

## Order COLYMBIFORMES—Grebes

## Family Colymbidae—Grebes

*Colymbus auritus* (Linnaeus). Horned Grebe

Fairly common winter visitant off-shore. Three specimens taken at Hyperion by Willett, Mar. 10, 1911, and Jan. 3, and 8, 1912 (Willett Coll.); one by Wyman, Jan. 29, 1917; and one by Bishop, Apr. 19, 1923 (Bishop Coll.).

*Colymbus nigricollis californicus* (Heermann). Eared Grebe

Common winter visitant off-shore, in tidal sloughs of salt marsh, and occasional in Ballona Creek. Four specimens from Hyperion as follows: Oct. 30; Dec. 29; Jan. 10, and 29.

*Aechmophorus occidentalis* (Lawrence). Western Grebe

Common winter visitant off-shore and in tidal sloughs and lagoon of the salt marsh. Ten specimens: earliest fall record, Nov. 21, 1915 (J. Hornung); latest spring record, Mar. 9, 1916 (Wyman).

*Podilymbus podiceps podiceps* (Linnaeus). Pied-bill Grebe

Occasional off-shore in winter, but more common in tidal sloughs of the salt marsh and in Ballona Creek. Sight records only.

## Order PROCELLARIIFORMES—Tube-nosed Swimmers

## Family Procellariidae—Shearwaters and Fulmars

*Puffinus tenuirostris* (Temminck). Slender-bill Shearwater

Of irregular occurrence off-shore in winter. Specimen taken at Hyperion by L. H. Miller, Nov. 22, 1913 (Miller, 1914, p. 41); and remains of another found dead on beach at same locality by Wyman, Dec. 15, 1915 (Wyman, 1916, p. 203).

*Puffinus griseus* (Gmelin). Sooty Shearwater

Common resident off-shore, frequently observed in large flocks just outside the breakers. Most abundant from late April to November (Willett, 1933, p. 14). Thirteen specimens: earliest, Apr. 14, 1916; latest, Nov. 5, 1918.

*Puffinus opisthomelas* (Coues). Black-vented Shearwater

Common off-shore from middle May to early March, but most abundant in fall and winter. Two specimens taken at Hyperion by Wyman, Mar. 22, 1916.

*Puffinus creatopus* (Coues). Pink-footed Shearwater

Common in summer and fall on open ocean. One specimen taken by Wyman at Hyperion, Apr. 24, 1916.

*Fulmarus glacialis rodgersii* (Cassin). Pacific Fulmar

Of common, though irregular occurrence off-shore in fall, winter, and spring. Occasionally observed on shore or on Hyperion pier. Dead individuals frequently found washed ashore after storms. Thirty-three specimens from Hyperion; earliest in fall, Oct. 30, 1910 (Jay); latest in spring, Apr. 17, 1932 (Wyman).

## Family Hydrobatidae—Petrels

*Oceanodroma melania* (Bonaparte). Black Petrel

A common pelagic resident. Dead specimen picked up on beach at El Segundo by the writer, Mar. 6, 1932.

*Oceanodroma homochroa* (Coues). Ashy Petrel

Has been recorded in spring, summer, and fall off southern California coast. A specimen found dead at Playa del Rey beach by the writer, Dec. 12, 1934, indicates occurrence in winter as well.

## Order PELECANIFORMES—Totipalmate Swimmers

## Family Pelecanidae—Pelicans

*Pelecanus occidentalis californicus* (Ridgway). Brown Pelican

A common coastal resident. Breeds on several of the Channel Islands, off southern California, and on Los Coronados Islands, Mexico. Occasionally a dead bird is found washed ashore and often individuals may be observed sunning themselves on the beaches or resting at the edge of the salt marsh lagoon. Eight specimens examined from Hyperion.

## Family PHALACROCORACIDAE—Cormorants

*Phalacrocorax auritus albociliatus* (Ridgway)

## Farallon Cormorant

Common coastal resident. Frequently seen on the ocean off-shore, on the beach, and in the salt marsh lagoon; occasionally observed in swift flight over the sand dunes, inland bound. Commonly nests on the Channel and Los Coronados Islands. Nine specimens examined from Hyperion.

*Phalacrocorax penicillatus* (Brandt). Brandt Cormorant

Common coastal resident. Breeds on the Channel Islands. Seven specimens examined from Hyperion.

*Phalacrocorax pelagicus resplendens* (Audubon)

## Baird Cormorant

Occasional along shore in winter. Breeds on the Channel Islands. Dead individual found on the beach at Hyperion, Jan. 6, 1919 (Wyman, 1919, p. 172).



## Family FREGATIDAE—Man-o'-war-birds

*Fregata magnificens* (Mathews). Man-o'-war-bird

Occasional stragglers wander north from Lower California to Santa Monica Bay and may be seen at almost any time from June to December (Willett, 1933, pp. 20-21).

## Order CICONIIFORMES—Stork-like Birds

## Family ARDEIDAE—Hérons, Egrets and Bitterns

*Ardea herodias hyperonca* (Oberholser). Great Blue Heron

Frequently observed in the meadow area and in the salt marsh. Occasionally individuals may be observed on the beach or flying overhead.

*Casmerodius albus egretta* (Gmelin). American Egret

Occasionally seen in all seasons in the salt marsh. Rarely observed flying over the sand dunes or beach.

*Egretta thula brewsteri* (Thayer and Bangs). Snowy Egret

Rarely observed in the Playa del Rey salt marsh. One seen perched on the Hyperion pier, October 31, 1931.

*Butorides virescens anthonyi* (Mearns). Anthony Green Heron

Occasional in spring and fall in tule-bordered ponds about one mile north of Playa del Rey. Specimen taken at edge of Ballona Creek, near Playa del Rey, Feb. 2, 1929, by the writer.

*Nycticorax nycticorax hoactli* (Gmelin).

Black-crowned Night Heron

Occasionally seen flying over the sand dunes and meadow in early morning or just at dusk; frequently observed roosting in willow thickets of the salt marsh area. Specimen taken by Wyman at Hyperion, Nov. 15, 1916.

*Botaurus lentiginosus* (Montagu). American Bittern

Fairly common in fall, winter, and spring in the tule swamps of the salt marsh area.

*Ixobrychus exilis hesperis* (Dickey and van Rossem).

Least Bittern

Formerly rarely seen in late spring and summer in vicinity of tule-bordered ponds and sloughs in the salt marsh. As a result of the elimination of many of the tule patches, this species may no longer occur in the area under consideration.

## Family THRESKIORNITHIDAE—Ibises

*Plegadis guarana* (Linnaeus). White-faced Glossy Ibis

Occasional visitant. Two specimens taken by S. Flintham, Oct. 10, 1921, in the salt marsh at Playa del Rey.

## Order ANSERIFORMES—Anserine Birds

## Family ANATIDAE—Swans, Geese, and Ducks

*Anas platyrhynchos platyrhynchos* (Linnaeus). Mallard

Occasional winter visitant in vicinity of the salt marsh lagoon and Ballona Creek. Has been observed here in small numbers from early October to early April.

*Mareca americana* (Gmelin). Baldpate

Common winter visitant on the salt marsh lagoon and occasional on ocean. Adult female collected at Hyperion by Wyman, Oct. 16, 1916.

*Dafla acuta* (Linnaeus). Pintail

Abundant winter visitant on salt marsh lagoon. Formerly bred in the salt marsh in small numbers as attested by downy young collected by P. E. Trapier in May, 1928, and an addled egg found by L. A. Sanford, June 13, 1931. Since reclamation of a large part of the marshland for agricultural purposes and the development of a large oilfield, this species may no longer breed there. An immature female was taken at Hyperion, Oct. 21, 1918, by Wyman.

*Querquedula cyanoptera* (Vieillot). Cinnamon Teal

Common spring and fall migrant in the salt marsh, a few remaining throughout summer and fall. Occasionally breeds there.

*Nyroca americana* (Eyton). Redhead

Occasional in winter on the salt marsh lagoon.

*Nyroca valisneria* (Wilson). Canvasback

Fairly common in winter on the salt marsh lagoon.

*Nyroca affinis* (Eyton). Lesser Scaup Duck

Common in winter on the ocean and at the salt marsh lagoon. Adult female taken at Hyperion, Nov. 21, 1922, by Wyman.

*Glaucionetta clangula americana* (Bonaparte).

American Golden-eye

Occasional visitant. Approximately 12 seen at Playa del Rey, April 23, 1928 (Schneider, 1928, p. 282).

*Charitonetta albeola* (Linnaeus). Buffle-head

Occasional in winter on the salt marsh lagoon. Generally arrives in fall migration in late October and leaves in spring in latter part of March or early April.

*Melanitta deglandi* (Bonaparte). White-winged Scoter

Common winter visitant. Six specimens from Hyperion. Present from mid-September to late April.

*Melanitta perspicillata* (Linnaeus). Surf Scoter

Abundant throughout winter from October to April. Twelve specimens examined from Hyperion.

*Oidemia americana* (Swainson). American Scoter

Rare winter visitant. Adult female taken at Hyperion, Nov. 24, 1915, by Wyman, in Bishop Collection (Wyman, 1916, p. 203).

*Erismatura jamaicensis rubida* (Wilson). Ruddy Duck

Common winter visitant on salt marsh lagoon and on ocean. Formerly nested in the salt marsh and may still do so in small numbers.

*Lophodytes cucullatus* (Linnaeus). Hooded Merganser

Rare winter visitant on the salt marsh lagoon. Adult female taken by A. E. Jackson at Playa del Rey, Nov. 27, 1913 (Chambers, 1914, p. 62).

*Mergus merganser americanus* (Cassin). American Merganser

Moderately common winter visitant on the ocean and salt marsh lagoon.

*Mergus serrator* (Linnaeus). Red-breasted Merganser

Fairly common in fall, winter, and spring on the salt marsh lagoon and the ocean. Occasional in summer as attested by three immature individuals observed near Playa del Rey, June 25, and July 2, 1929 (Stevenson, 1932, p. 229).

## Order FALCONIFORMES—Birds of Prey

### Family CATHARTIDAE—American Vultures

*Cathartes aura septentrionalis* (Wied). Turkey Vulture

A common resident, though not a breeding species, of the sand dunes region. Most frequently observed in soaring flight over the meadow and largest sand dunes. Five specimens taken by Wyman at Hyperion, one each in the months of March, May, June, July and August.

### Family ACCIPITRIDAE—Hawks and Eagles

*Accipiter velox velox* (Wilson). Sharp-shinned Hawk

Occasionally seen in late fall, winter and spring in the mea-



dow area, usually perched on some vantage point such as a telephone pole or wire. On October 25, 1931, a sharp-shinned hawk was observed to swoop into the midst of a covey of California quail, striking and instantly killing a female just after she burst into flight. The hawk was shot a few minutes later as it circled to return for its prey and both specimens were preserved by the writer.

*Accipiter cooperii* (Bonaparte). Cooper Hawk

Although the Cooper Hawk may be present in this region throughout most of the year, only once has it been observed here by the writer. On the morning of August 22, 1931, an adult (female?) was seen perched on top of a telegraph pole near the intersection of Imperial Highway and Manhattan Boulevard; therefore, in the meadow area.

*Buteo borealis calurus* (Cassin). Western Red-tail Hawk

Resident, but not common. Often observed in soaring flight above the dunes and meadow. An occupied nest was found high in a eucalyptus tree near Palisades del Rey on March 6, 1932. It was not determined whether there were eggs in the nest at the time, but on April 10, 18, and 30, of that year, the adults were observed bringing ground squirrels and cottontail rabbits to the nest.

*Haliaeetus leucocephalus leucocephalus* (Linnaeus). Bald Eagle

Rare; occasionally observed in soaring flight over the dunes, beach and salt marsh. One individual that was unable to fly due, apparently, to oil on its plumage, was observed near the salt marsh lagoon on July 22, 1928.

*Circus hudsonius* (Linnaeus). Marsh Hawk

Resident in small numbers. Frequently seen foraging in the salt marsh, meadow, and sand dunes. Two specimens taken at Playa del Rey, Jan. 3, 1923, by O. M. Thurston.

Family FALCONIDAE—Caracaras and Falcons

*Falco peregrinus anatum* (Bonaparte). Duck Hawk

Rare fall and winter visitant. Two specimens, as follows: skeleton of an adult female taken at Hyperion by Wyman, Nov. 21, 1922; and skin of an adult female taken at Playa del Rey by H. Washeur, Sept. 5, 1939.

*Falco sparverius sparverius* (Linnaeus). Sparrow Hawk

Common resident, nesting in the meadow and sand dune areas in April and May. Forages in the salt marsh as well as in the meadow and sand dunes, feeding on grasshoppers, crickets, beetles, lizards, and small mammals.

## Order GALLIFORMES—Gallinaceous Birds

## Family PHASIANIDAE—Pheasants and Quail

*Lophortyx californica californica* (Shaw). California Quail

Common resident of the meadow and meadow slope of the dunes. Nests here between middle April and late June. Adult birds with coveys of young observed in the meadow in July and August, 1931; in May, 1932; and in May, June, and July, 1939 and 1940.

## Order GRUIFORMES—Cranes, Rails, and Coots

## Family GRUIDAE—Cranes

Rare migrant; probably no longer occurs in this region. There is an adult male in the Bishop Collection taken near Culver City, Mar. 3, 1929, by G. P. Ashcraft.

## Family RALLIDAE—Rails, Coots, and Gallinules

*Rallus obsoletus levipes* (Bangs). Light-footed Rail

Resident of the salt marsh, breeding there in April and early May. Adult male taken at Playa del Rey, August 29, 1933, by Mrs. A. V. Dedrick.

*Rallus limicola limicola* (Vieillot). Virginia Rail

Resident of the salt marsh. Two sets of fresh eggs collected by W. L. Chambers at Ballona, Apr. 13, 1902 (Willett, 1933, p. 52).

*Porzana carolina* (Linnaeus). Sora Rail

Present in small numbers throughout the year in the salt marsh, most frequently being found in vicinity of tule-bordered ponds and creeks. Breeds in April and May.

*Creciscus jamaicensis coturniculus* (Ridgway). Black Rail

Rare, or at least inconspicuous, resident of the salt marsh. Records for this area are as follows: one seen by G. F. Morcom, May 16, 1895 (Grinnell, 1898, p. 16); adult found impaled on barbed-wire fence by J. Ewan, Feb. 25, 1928 (Ewan, 1928, p. 247).

*Fulica americana americana* (Gmelin). American Coot

Abundant in winter, less common in summer, on sloughs and lagoons in the salt marsh; occasional on the ocean off Playa del Rey and Hyperion. Breeds from mid-April to mid-June.

## Order CHARADRIIFORMES—Shore-birds, Gulls, etc.

## Family CHARADRIIDAE—Plovers

*Charadrius nivosus nivosus* (Cassin). Snowy Plover

Common resident of the strand and embryonic dunes. Nests from April to August on sandy beaches. Three specimens taken by Wyman at Hyperion in October and November.

*Charadrius semipalmatus* (Bonaparte). Semi-palmated Plover

Common migrant along the beaches. Six specimens taken by Wyman at Hyperion in August and September.

*Oxyechus vociferus vociferus* (Linnaeus). Killdeer

Common resident throughout this region. Nests in the salt marsh and meadow areas from March until late May.

*Pluvialis dominica dominica* (Muller). Golden Plover

Four single sight records from Playa del Rey, as follows: Oct. 14, 1923 (Schneider, 1923, p. 409; Bicknell, 1924, pp. 77-78); Sept. 4, 1924, Nov. 9, 1926, and Nov. 27, 1927 (Schneider, 1924, p. 427; 1927, p. 64; and 1928, p. 24). In the absence of actual specimens, these sight records do not appear sufficient to prove presence of the American golden plover in this region through the winter (see Willett, 1933, p. 57).

*Squatarola squatarola* (Linnaeus). Black-bellied Plover

Common spring and fall migrant along shore and in the salt marsh, small numbers remaining throughout winter. Eighteen specimens examined from Hyperion.

*Aphriza virgata* (Gmelin). Surf-bird

One record: specimen taken at Hyperion, May 1, 1915 (Wyman, 1916, p. 203; Willett, 1933, p. 58).

*Arenaria interpres morinella* (Linnaeus). Ruddy Turnstone

One individual observed during winter at Playa del Rey (Schneider, 1926, p. 149; Willett, 1933, p. 59).

*Arenaria melanocephala* (Vigors). Black Turnstone

Several observed at Hyperion, July 28, 1910 (Willett, 1912, p. 42; 1933, p. 59). Adult male collected by Wyman at Hyperion, May 26, 1919.

## Family SCOLOPACIDAE—Curlews, Sandpipers, etc.

*Numenius americanus americanus* (Bechstein).

## Long-billed Curlew

Occasional on ocean shore throughout year and common in the salt marsh in fall, winter, and spring. Four specimens examined from Hyperion.



*Numenius americanus parvus* (Bishop). Northern Curlew

Fairly common in late fall and winter in this area. Three specimens taken at Hyperion by Wyman, Oct. 3, and Nov. 9, 1916, and Oct. 10, 1918.

*Phaeopus hudsonius* (Latham). Hudsonian Curlew

Common spring and fall migrant along shore and in the salt marsh. A few remain here throughout the winter. Eighteen specimens from Hyperion and five from Playa del Rey examined.

*Actitis macularia* (Linnaeus). Spotted Sandpiper

One record: an immature specimen taken by Wyman at Hyperion, Aug. 22, 1916. The lack of a rocky shore-line apparently renders the region unattractive to this species.

*Heteroscelus incanus* (Gmelin). Wandering Tattler

One record: an adult male taken at Hyperion, May 11, 1916, by Wyman. Like the preceding species, the tattler is more at home along rocky shores than on the sandy type of beaches prevailing in this region.

*Catoptrophorus semipalmatus inornatus* (Brewster)

## Western Willet

May be found along the beaches and in the salt marsh throughout the year, but most common in fall migration. Not known to breed here. Eight specimens examined from Hyperion.

*Totanus melanoleucus* (Gmelin). Greater Yellow-legs

Common along shore and in salt marsh in migrations. Occasional in summer and not common in winter.

*Totanus flavipes* (Gmelin). Lesser Yellow-legs

Rare migrant. Recorded by Mrs. F. B. Schneider as seen on several occasions at Playa del Rey in September, 1924 and 1925, and in August and October, 1926 (Willett, 1933, pp. 63-64).

*Calidris canutus rufus* (Wilson). American Knot

Common fall migrant, less common in spring. There are several published sight records by reliable observers in the Playa del Rey area indicating the presence of this species from late April to early June, and from mid-August to mid-September (Willett, 1933, p. 64).

*Pisobia melanotos* (Vieillot). Pectoral Sandpiper

Rare migrant. Observed near Playa del Rey, Sept. 16, 1923, and Sept. 15, 1927 (Schneider, 1923, p. 409; 1927, p. 438; Wyman 1924, p. 36).

*Pisobia bairdii* (Coues). Baird Sandpiper

Rare migrant along shore, most frequently seen in fall. Seven autumn-taken specimens collected by Wyman at Hyperion.

*Pisobia minutilla* (Vieillot). Least Sandpiper

Common in fall, winter, and spring along shore and in the salt marsh. Three specimens taken by Wyman at Hyperion in September, 1919.

*Pelidna alpina sakhalina* (Vieillot). Red-backed Sandpiper

Common migrant along shore, occasional in winter. One specimen taken at Hyperion by Wyman, May 5, 1919.

*Limnodromus griseus griseus* (Gmelin). Eastern Dowitcher

Common migrant along shore and on the mud flats in the salt marsh. Occasional winter visitant.

*Limnodromus griseus scolopaceus* (Say). Long-billed Dowitcher

Common migrant in the salt marsh and along shore, usually in company with the preceding race. Moderately common winter and summer visitant.

*Ereunetes mauri* (Cabanis). Western Sandpiper

Abundant spring and fall migrant along shore and in the salt marsh; less common summer and winter visitant. Four specimens taken at Hyperion by Wyman.

*Limosa fedoa* (Linnaeus). Marbled Godwit

Abundant migrant along shore and in the salt marsh; less common, but present, throughout winter; rare in summer. Fifteen summer and fall specimens from Hyperion examined.

*Crocethia alba* (Pallas). Sanderling

Common along shore from mid-August to late May; occasional in summer. Nineteen specimens examined from Hyperion.

## Family RECURVIROSTRIDAE—Avocets and Stilts

*Recurvirostra americana* (Gmelin). Avocet

Moderately common migrant in the salt marsh area; occasional in winter. Rarely seen along ocean shore. Two specimens taken by L. F. Moss at Playa del Rey, Nov. 1, 1916.

*Himantopus mexicanus* (Müller). Black necked Stilt

Summer resident, nesting in the salt marsh though not so commonly as in former years; rare in winter. Occasionally seen along shore.

## Family PHALAROPODIDAE—Phalaropes

*Phalaropus fulicarius* (Linnaeus). Red Phalarope

Abundant migrant off-shore, occasionally wintering on the lagoon and sloughs of the salt marsh. Six specimens taken by Wyman at Hyperion, three each in May and November.

*Steganopus tricolor* (Vieillot). Wilson Phalarope

Common late spring and early fall migrant along shore and on the salt marsh lagoon. Several published records for this area (see Willett, 1933, p. 70).

*Lobipes lobatus* (Linnaeus). Northern Phalarope

Abundant migrant off-shore, along shore, and on the salt marsh lagoon and sloughs. Winter records lacking.

## Family STERCORARIIDAE—Jaegers and Skuas

*Stercorarius parasiticus* (Linnaeus). Parasitic Jaeger

Common fall migrant along shore; occasional in winter and spring. Seven specimens (including 3 in Willett Coll. and 1 in Bishop Coll.) taken at Hyperion between Nov. 22 and Jan. 26.

## Family LARIDAE—Gulls and Terns

*Larus hyperboreus* (Gunnerus). Glaucous Gull

Uncommon winter visitant along shore. Five specimens taken at Hyperion, one each on the following dates: Nov. 24; Jan. 10, and 28; Mar. 13 (Bishop Coll.), and 26.

*Larus glaucescens* (Naumann). Glaucous-winged Gull

Fairly common winter visitant along shore; rare in summer. Forty-one specimens from Hyperion: earliest fall record, Dec. 3; latest spring record, May 9; one summer record, July 4, 1910 (Willett Coll.).

*Larus occidentalis wymani* (Dickey and van Rossem).

## Western Gull

Abundant resident throughout the region; breeds on the Channel Islands in May and June. One hundred and eighty-seven specimens from Hyperion, representing individuals taken in every month of the year.

*Larus argentatus smithsonianus* (Coues). Herring Gull

Common winter visitant along shore. Thirty-five specimens from Hyperion: earliest fall record, Nov. 22 (Willett Coll.); latest spring record, May 9.



*Larus argentatus thayeri* (Brooks). Thayer Gull

Occasional winter visitant. Five adult female specimens from Hyperion: Dec. 30, 1918, and Feb. 3, 1919 (Los Angeles Museum); and Jan. 6, 1919, Jan. 18, and Mar. 14, 1922 (Bishop Coll.).

*Larus californicus* (Lawrence). California Gull

Common in fall, winter and spring along shore, but most abundant in the salt marsh. Frequently seen in large numbers, following the plough, when fields are being cultivated in the meadow area. Seventy-five specimens from Hyperion: earliest in fall, Aug. 11; latest in spring, June 23.

*Larus delawarensis* (Ord.). Ring-billed Gull

Occurrence in general about the same as the preceding species. Thirty-four specimens from Hyperion: earliest, Aug. 27; latest, June 13.

*Larus canus brachyrhynchus* (Richardson). Short-billed Gull

Common winter visitant along shore. Eighty-four specimens from Hyperion: earliest, Nov. 17; latest, Apr. 1.

*Larus pipixcan* (Wagler). Franklin Gull

Accidental fall migrant, rare. Four specimens, all immature, taken at Hyperion by J. E. Law and L. E. Wyman, as follows: Nov. 22, 1913, and Oct. 17, and Nov. 24, 1914 (Law, 1915, p. 96); and Oct. 29, 1917 (Wyman, 1918, p. 192).

*Larus philadelphia* (Ord.). Bonaparte Gull

Common along shore and at salt marsh lagoon in late fall, winter, and early spring. Twenty-six specimens from Hyperion: earliest, Nov. 12; latest, May 26.

*Larus heermanni* (Cassin). Heermann Gull

Present along shore the year around, but least common in March and April. At this time the majority of the population, contrary to all our other species of gulls, goes south to breed on islands off the Mexican coast. Forty-eight specimens from Hyperion, as follows: Jan., 4; Feb., 14; Mar., 3; Apr., 2; May, 1; June, 1; July, 10; Aug., 4; Oct., 5; Nov., 2; Dec., 3. Though no specimens in the collection were taken in September, nevertheless, this species occurs in the region in that month.

*Rissa tridactyla pollicaris* (Ridgway). Pacific Kittiwake

Rare winter visitant. Two records from Playa del Rey: immature female, Jan. 9, 1906 (Grinnell, 1906, p. 57); and immature male, Dec. 30, 1911, taken by A. Jay. Also one record for Hyperion: wing and skull of adult, Mar. 8, 1916, taken by Wyman. All three specimens were found dead on the beach.

*Xema sabini* (Sabine). Sabine Gull

Common fall migrant off-shore, occasional along shore in spring. One sight record for Playa del Rey, April 22, 1926 (Schneider, 1926, p. 178).

*Sterna forsteri* (Nuttall). Forster Tern

Common along shore and in the salt marsh in fall, winter, and spring; occasional in summer. Three specimens examined from Hyperion, taken Oct. 21, Jan. 29, and Feb. 22.

*Sterna hirundo hirundo* (Linnaeus). Common Tern

Common migrant off-shore, less common along shore and in the salt marsh area. Three specimens from Hyperion, taken Oct. 21, and May 24, and 29.

*Sterna antillarum* (Lesson). Least Tern

Moderately common summer resident along shore, though much less common than formerly. A few attempt to nest each summer on the beaches at Playa del Rey and El Segundo. They frequently are seen throughout the summer, foraging over the salt marsh lagoon. One specimen, a breeding male, collected by Wyman at Hyperion, June 4, 1917. Latest fall record: birds seen at Playa del Rey, Oct. 15, 1927 (Schneider, 1928, p. 23).

*Sterna maxima maxima* (Boddaert). Royal Tern

Occasional along shore and in the salt marsh in fall, winter, and spring. According to Willett (1933, p. 78), formerly much more common than now.

*Sterna elegans* (Gambel). Elegant Tern

Irregular fall migrant along shore. Recorded as present at Playa del Rey in fall, 1926 (Schneider, 1927, p. 71).

*Sterna caspia* (Pallas). Caspian Tern

Uncommon winter visitant along shore and in the salt marsh; occasional in summer. Reported as seen at Playa del Rey, June 20, 1925, and in late August, 1927 (Schneider, 1925, p. 348; Michener, 1928, p. 132).

*Chlidonias nigra surinamensis* (Gmelin). Black Tern

Common migrant off-shore, along shore, and in the salt marsh. Found abundantly at Hyperion by Willett (1912, p. 16; 1933, p. 79), Aug. 20 to Sept. 10, 1910. Observed by Mrs. F. B. Schneider at Playa del Rey in June and July, 1924; July, 1925; and August, 1926 (Willett, *loc. cit.*). Adult male collected by the writer from flock of twenty individuals flying over the salt marsh lagoon, July 15, 1928.

## Family ALCIDAE—Auklets, Murrelets, etc.

*Synthliboramphus antiquus* (Gmelin). Ancient Murrelet

Coastal winter visitant. Dead birds occasionally found washed up on beaches. One such specimen preserved by Willett, Jan. 9, 1918, from Hyperion. Others found by him at same locality, Mar. 17, 1910 (Willett, 1912, p. 11; 1933, p. 82).

*Ptychoramphus aleuticus* (Pallas). Cassin Auklet

Common coastal resident. Skeleton of dead bird found on beach at El Segundo, Oct. 26, 1939, preserved by the writer. Breeds on the Channel Islands, off southern California.

*Cerorhinca monocerata* (Pallas). Rhinoceros Auklet

Common coastal winter visitant. Four specimens found dead on beach at Hyperion, as follows: Nov. 25, 1911, by Willett; Dec. 22, 1911, by Jay; Jan. 18, 1918, and Feb. 7, 1916, by Wyman.

## Order COLUMBIFORMES—Pigeon-like Birds

## Family COLUMBIDAE—Pigeons and Doves

*Zenaidura macroura marginella* (Woodhouse).

## Western Mourning Dove

Common resident of the meadow area. Generally nests here in May. Two eggs comprise a set, which may be laid on the ground or, more usually, in a poorly made nest in a small tree or large bush.

(To be continued in Part 2 of Vol. 42)



CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM  
- CHANNEL ISLANDS BIOLOGICAL SURVEY28. THREE NEW PLANTS FROM SAN CLEMENTE  
ISLAND

By M. B. DUNKLE

San Clemente Island has been less intensively studied from the botanical standpoint than any other of the Channel Islands. The heavy grazing of sheep and goats in the past gave such a desolate appearance to the island that it seemed superficially of but little interest to the botanist. The distance of the island from the mainland also contributed to the accessibility, while the use of the island by the navy during recent years has made access to the island very difficult. There have been four expeditions by the Los Angeles Museum Channel Islands Biological Survey, but as these were all of relatively short duration it cannot be hoped that the flora of the island has been more than superficially sampled. The writer has collected several plants in the immature stage that are probably new to science, but the lack of material renders their description impossible at present. The three plants described in this paper were collected on the second, third and fourth expeditions.

*Castilleja grisea* was collected on the edge of the second terrace above Pyramid Cove on April 2, 1939, Dunkle number 7201. This plant is closest to *Castilleja hololeuca* Greene, but is distinctly different in general appearance, since it is more straggly, has a distinctly gray appearance and has dull yellow flowers. The pubescence is much shorter and more sparse, while the bracts are shorter with three divaricate lobes. Part of the differing appearance might well be owing to the arid habitat, but this would not explain the diminished pubescence, the color of the flower, or the difference in the bracts. The general appearance of *C. foliolosa* H. & A. and *C. hololeuca* Greene holds more similarities than either does to this proposed species.

## CASTILLEJA GRISEA spec. nov.

Erect, woody, much branched suffrutescent shrub, 5-6 dm. high, with grayish tomentum; leaves linear, crowded on sterile shoots, 1-3 cm. long; bracts short, with three narrow divaricate lobes, brownish, 8-10 mm. long; calyx cleft above, inflated in fruit; corolla 1.5-2 cm. long, dull yellow, galea lightly villus on midrib, lower lip exserted.

Caules erecti, lignosi inferiore, suffrutescentes, griseo tomentoso, 5-6 dm. alti; foliis linearibus, confertis in ramosis sterilibus, pubescente-griseis, 1-3 cm. longis; calyce inciso superiore, 10 mm. longo; corolla ochraceo, 1.5-2 cm. longa; galea leviter puberulente in mediacosta, labro inferiore exserto.

The new variety of *Ribes* was collected at the head of a canyon on the eastern breaks of the island Nov. 24, 1939, Dunkle number 7338. This plant is closely related to *R. malvaceum* Smith, but is distinctly different in its thinner leaves with their acute serrations, and much less tomentum on the lower surface. The racemes have more flowers, and the flowers have shorter pedicels and a distinctly longer hypanthium, than has the species. The leaves are distinctly different from those of the variety *viridifolium* Abrams, as they are shorter, lighter in color, and have acute serrations.

*RIBES MALVACEUM* Smith, var. *CLEMENTINUM* var. nov.

Differs from the species in the following respects: erect shrub 2-4 m. high; leaves 3 (-5) lobed, thin, finely rugose, biserrate, nearly glabrous above, thinly short white-wooly below, 2-4 cm. broad, 1.5-3.2 cm. long; petioles shorter than the leaves, glandular-tomentose; racemes 15-20 flowered; pedicels 2-3 mm. long; hypanthium light rose, campanulate-urceolate, 6-8 mm. long; sepals creamy rose, recurved, about 2.5 mm. long; petals cream colored, about 1 mm. long; style sparsely villous.

A specie differens sic: 2-4 m. altis; foliis 3 (-5) lobatis, tenibus, subiter-rugosis, biserratis, supra prope nudis, infra incanis, 2-4 cm. latis, 1.5-3.2 cm. longis; petiolis brevioribus foliis, glanduloso-tomentosis; racemis 15-20 floribus; pedicellis 2-3 mm. longis; hypanthiis rosaceis, campanulato-urceolatis, 6-8 mm. longis; sepalis incarnatis, recurvatis, circa 2.5 mm. longis; petalis eburneis, circa 1 mm. longis; stilis leviter villosis.

*Lupinus Moranii* was collected on the gravelly bank of the short-lived stream in Middle Ranch Canyon by Reid Moran on February 18, 1941, Moran number 587.

This tall, coarse, fistulose annual seems most closely related to *L. nanus* Dougl. but the superficial appearance of the plant and its legumes are entirely different. The other annual Lupine found on San Clemente is *L. succulentus* Dougl. and while this plant is somewhat different from the mainland form it is still far from this new species which is villous with much longer leaflets than occur in either *L. succulentus* or *L. nanus*. Like *L. succulentus* there are usually nine leaflets. The habit of the inflorescence re-

sembles somewhat that of *L. nanus* but is even less verticillate. There is no light colored spot on the banner as in the two other related forms. While far out of the range of *L. nanus* this fact alone would not rule out the consideration that it might not be found on San Clemente as *Brodiaea laxa* Wats. of the same range is also found on San Clemente, but the several distinct points of difference point to this plant as being clearly of specific rank.

LUPINUS MORANII spec. nov.

Annual; stems coarse, hollow, erect, branching above, lightly white-tomentose, 6-12 dm. high; leaflets narrow-elliptical, obtuse, 2-5 cm. long; petioles 4-7 cm. long; stipules jointed with petioles for a short distance, filiform, 10-12 mm. long; racemes but little exceeding the leaves, subverticillate, 12-15 cm. long; flowers blue, 12-15 cm. long; peduncles 5-8 mm. long, linear, villous; bracts falling early, linear, about equalling buds; calyx sub-saccate above; banner reflexed, purplish, orbicular, shorter than the wings; wings 8 mm. broad; keel falcate, with dark purplish tip, ciliate above on the acumen; pods silvery-silky with long hairs, 2-5 cm. long, about 8 mm. wide, with 4-5 seeds.

Annuus; caulibus robustis, fistulosis, erectis, ramosis supra, leviter, albo-tomentosis, 6-12 dm. altis; foliolis anguste-lanceolatis, obtusis, 2-5 cm. longis; petiolis 4-7 cm. longis; stipulis brevianatis, filiformibus, 10-12 mm. longis; racemis paulo superantibus folia, sub-verticillatis, 15-20 cm. longis; floribus cyaneis, 12-15 mm. longis; calyce subsaccato supra; vexillo reflexo, violaceo, orbiculariis, brevioris alis; alis 8 mm. latis; pedunculis 5-8 mm. longis; bracteis linearibus, aequilongis gemmis; carina falcata, ciliata supra medium, apice purpureo; leguminibus argenteo-sericeis longissime, 2-5 cm. longis, circa 8 mm. latis; seminibus 4 vel 5.



## NOTES ON CALIFORNIA SPIDERS

## 3. ON THE LIFE HISTORY AND PROGRESSIVE FACTOR IN GROWTH OF TEUTANA GROSSA KOCH

By JEFFERSON H. BRANCH

Dr. W. Dwight Pierce<sup>1</sup> was the first to record the spider *Teutana grossa* (C. Koch 1838) Simon 1881 (= *Theridion nitidum* Holmberg 1875, *Teutana zonata* Cambridge 1899) from California, and to publish concerning its ability to destroy the Black Widow. This latter fact alone would seem to justify considerable research on the life history of *Teutana*. Moreover, the adaptability of this species to laboratory culture adds considerably to its importance.

The present paper is a brief summary of notes based on observations made for the most part upon spiders raised in the laboratory. The use of the facilities of the Los Angeles County Museum of History, Science, and Art made this study possible. The writer gratefully acknowledges receiving inspiration and direction from Dr. W. Dwight Pierce. Valued assistance in the care of the spiders was given by Evert Schlinger.

One hundred seventy-eight spiders were raised to maturity. Over a thousand spiders were raised to various stages of growth for different experimental purposes. Culture methods were outlined in a previous paper<sup>2</sup>.

## COCOON AND EGG DEVELOPMENT

Under favorable conditions cocoons were usually deposited by gravid females from 24 to 36 days apart, depending on temperature and humidity. An abundance of food given to the spiders did not greatly increase the velocity of oviposition. Young spiders left their cocoons from 24 to 36 days after the eggs were deposited. When the spider and her cocoon of eggs were kept under exactly the same physical conditions of temperature and humidity she usually deposited her next cocoon within 48 hours of the time the spiderlings issued from her previous cocoon. This fact seems important, for it strongly suggests that whatever factors influence rate of oviposition also influence egg development and the growth of the spider within the cocoon.

<sup>1</sup> Pierce, W. Dwight, 1942. Bull. So. Cal. Acad. Sci. Vol. 41, P. 16.

<sup>2</sup> Branch, Jefferson H., 1943. Bull. So. Calif. Acad. Sci. Vol. 41. P. 138.

One glaring exception to the normal course of egg development was observed. An egg ball was deposited on July 10th. The spiderlings from this ball did not emerge until October 17th, a little over three times the usual period between oviposition and emergence of the spiders from the cocoon. The delay can not be attributed to temperature or humidity, for other eggs from other spiders, kept under the same physical conditions at that time, hatched and the spiders emerged from their cocoons in 28 to 32 days.

Measurements of one hundred cocoons were taken, and the number of spiders which issued from each cocoon was noted. The diameter of the smallest cocoon was 4 mm., the largest was 12 mm. The majority of the cocoons were from 8 to 10 mm. in diameter. The number of spiders issuing from each cocoon ranged from 14 to 70. Only a small number of spiders issued from small cocoons, but otherwise no correlation was found to exist between the size of the cocoon and the number of spiders which issued. Neither was there any correlation found between the size of the cocoon and the size of the spider depositing the cocoon.

However, measurements of 42 cocoons, six successive cocoons deposited by each of seven different spiders, and the count of spiders from each cocoon, disclosed some interesting data. The sizes of the successive cocoons from each spider were fairly uniform, with a tendency to become when there was any change, slightly smaller. Furthermore, the number of spiders which issued from each of the six successive cocoons from one spider was nearly the same in each case, though there was a great variation in the number of spiders issuing from cocoons from different spiders.

#### GROWTH AND HABITS

The spiders molt once while in the cocoon. Upon emerging, they are able to spin silk and take food.

Under favorable conditions ecdysis occurs at intervals of 15 to 25 days. The normal number of molts is 8 for the female, 7 for the male; however, so frequently did the females mature after 7 molts and the males after 6 molts that there is a question as to which really is normal. The females usually deposited their first cocoon fourteen days after mating. No spider was known to cast another skin after once depositing an egg ball. The possible longevity of females is something over two years. The males ceased eating after maturing, and the writer has never been able

to keep a male alive over seven months. A random selection of spiders chosen to be raised to maturity from various lots revealed a sex proportion of 2 males to 1 female.

All of the skins cast outside the cocoon by 20 spiders were mounted in balsam on glass slides. A series of these skins from one spider gives a permanent and accurate instar by instar picture of its growth. The skins should be mounted soon after they are cast, while they are still pliable. For measuring purposes they should be fixed on the slides ventral side up, with legs and palpi spread out, and the carapace of the cephalothorax carefully placed in the balsam to one side of the skin.

The growth shown by the increase in cephalothorax lengths of the cast skins of successive molts was carefully noted. Considerably more accurate measurements could be made upon the skin, which permitted close focusing of the microscope, than upon the live spider; furthermore, there was no over-hanging abdomen in the way.

In studying the growth rate the first molt was not considered, because between hatching and the first molt the spider is in a semi-embryonic state; moreover, the extreme difference in the lengths of the cephalothoraces in the second instar was so minute as to exclude probability of non-uniform growth up to that point. Bodenheimer's<sup>3</sup> general principle that growth of Arthropoda follows a progression factor of  $n$  1.26 for length is apparently valid for *Teutana* when the quotients of growth rate of all stages are averaged, and when the latent divisions are considered. An excellent example of latent division or non-manifested (by ecdysis) growth, and its influence on growth rate, is afforded by comparison of the instar by instar growth rate of spiders casting a different number of skins. (See Table.) Each quotient recorded is the average of several quotients arrived at by dividing the length of the carapace of the cephalothorax of one molt by the length of the carapace of the preceding molt. In order to show the true growth pattern the sexes were separated, and in each sex those molting one less time were separated. How *Teutana* reflects Bodenheimer's growth principle then becomes obvious. If all the quotients of the four series are averaged without regard to the latent division frequently occurring in both sexes, the number is 1.292. These data may indicate why Jones<sup>4</sup> working with *Agelena naevia* found the ratio to be 1.28.

<sup>3</sup> Bodenheimer, F. S., 1933. Quart. Rev. Bio., Vol. 8, P. 92.

<sup>4</sup> Jones, Sarah E., 1941. Annals Ent. Soc. Amer., Vol. 34, P. 570.



AVERAGE GROWTH RATE TABLE

Skins used for determining quotients	AVERAGE QUOTIENTS OF GROWTH INCREASE			
	FEMALES MOLTING 8 TIMES	FEMALES MOLTING 7 TIMES	MALES MOLTING 7 TIMES	MALES MOLTING 6 TIMES
3rd/2nd .....	1.302	1.375	1.333	1.398
4th/3rd .....	1.21	1.272	1.25	1.34
5th/4th .....	1.375	1.434	1.20	1.326
6th/5th .....	1.213	1.237	1.286	1.25
7th/6th .....	1.242	1.237	1.254	
8th/7th .....	1.253	One latent division		One latent division
Average .....	1.265	1.311	1.264	1.328

The great difference between the growth of the males and the females at the time of the fifth molting is significant. If experiments were conducted to show the influence of some external factor upon the growth, and if there were a preponderance of males or females in the control group, then the true influence of the external factor could easily be obscured, particularly at this stage.

Mortality was by far the highest at the second molting. Jones concluded that *Agelena* was least viable in the second instar. It therefore seems possible that upon further investigation this will be found to be true of all spiders which leave their cocoons shortly after the first molt.

## TEUTANA VS. BLACK WIDOW

The ability of the Teutana to kill the Black Widow was carefully investigated at each instar. The experiments were carried on under laboratory conditions, and the writer does not wish to imply that these experiments in any way indicate what happens under natural conditions.

Black Widows were placed with Teutanas of comparable age. Only when the Black Widow was fully matured was she an equal match for the Teutana. At all other stages the Teutana killed the Black Widow nine times out of ten. Frequently as high as 20% of Teutanas which had killed Black Widows died within three days. This led to some interesting speculation. The possibility that the Teutanas had died from feeding on the poisonous juices of the Black Widows was considered. However, when it was found that Teutanas could exist on a diet of Black Widows only, it seemed more logical to assume that they died from a bite inflicted during their struggle. If this is so, then it appears that the Teutana's venom is much more poisonous to the Black Widow than the Black Widow's venom is to the Teutana.



## HENRICUS, A NEW NAME FOR A PHALONIID GENUS

By AUGUST BUSCK

Bureau of Entomology and Plant Quarantine  
Agricultural Research Administration  
United States Department of Agriculture

In a generic review of the family Phaloniidae (Bull. So. Calif. Acad. Science, vol. 38, p. 103, 1939) I named a new genus *Heinrichia*, type *Commophila macrocarpana* Walsingham, in honor of my friend and coworker, Carl Heinrich. He has called my attention to the fact that this name was preoccupied in the birds by *Heinrichia* Streeseemann (Ornith. Monatsber., p. 9, 1931). The new name *Henricus* is therefore proposed for this genus.

Febr. 17, 1943.

## WESTERN POPLAR SPHINX

By JOHN A. COMSTOCK AND CHARLES M. DAMMERS.

Holland<sup>1</sup> applies the common name of Western Poplar Sphinx to the pale variety of *Pachysphinx modesta* which was named *occidentalis* by Henry Edwards. It seems to us justifiable to retain this varietal name, notwithstanding that it has been placed in the synonymy by McDunnough<sup>2</sup>. There is certainly a marked difference between the typical California examples and the dark form of the eastern seaboard, as may be noted by reference to Holland's color plate VII, figures 1 and 2.

We are well aware that typical dark examples of *modesta* are occasionally found in the west, and pale examples have been taken in the Mississippi Valley states. The fact remains that they represent extremes of variation that are most easily expressed by the use of the two names.

Our southern desert areas occasionally yield examples that closely approximate Strecker's<sup>3</sup> figure of *imperator*, and one of our Coachella Valley specimens is about intermediate between this and *occidentalis*.

This would seem to indicate that *imperator* is another western pale variety of *modesta* rather than a distinct species as listed by McDunnough.

The life history of *modesta* has been more or less completely described by a number of authors. A list of these is given at the end of these notes. The most complete account is that of Eliot and Soule in "Caterpillars and their Moths," and a good illustration of the larva appears therein. The metamorphosis of our western race, *occidentalis* has been only briefly (and somewhat inaccurately) touched upon by Heath<sup>4</sup>. Dyar<sup>5</sup> has given a good account of the mature larva of *imperator* in Insect Life. From these several published notes it would appear that the larvae of our western forms are somewhat lighter in coloration than those of eastern *modesta*. This fact, together with the paucity of illustrations in the literature justifies the publishing of the following notes.

## PACHYSPHINX MODESTA OCCIDENTALIS Hy. Edw.

EGG: Ovoid, slightly flattened, the surface smooth. Color, light buff. Length, 2.5 mm. Width, 2 mm.

<sup>1</sup> Holland, W. J., "The Moth Book," p. 57. 1908.

<sup>2</sup> McDunnough, J., Check List. Mem. So. Cal. Acad. Sci. 1: 38. 1938.

<sup>3</sup> Strecker, H., Lep. Rhop. Het. p. 125. Pl. XIV, fig. 3. 1872.

<sup>4</sup> Heath, E. F., Can. Ent. 26: 208. 1894.

<sup>5</sup> Dyar, H. G., Insect Life. 3: 390. 1891.



LARVA, FIRST INSTAR: Length, 7 mm.

Body, ground color bright green, covered with raised pale yellow dots. An indistinct sub-dorsal longitudinal narrow yellow band extends from the 2nd to the 10th segments. (This band is barely visible in the third instar.)

From the 4th to the 10th segments on each side occur diagonal stripes, each one beginning low down on the anterior edge of the segment and extending superiorly and dorsally to cross the next posterior segment subdorsally and meet with its fellow of the opposite side mid-dorsally.

The diagonal band which crosses the 10th segment begins in front of the last proleg on the 9th segment, and superiorly runs to the base of the caudal horn. All of these diagonals are yellow.

Caudal horn relatively long compared with that of the mature larva; soiled white, arising from a pale chestnut base.

Anal flap, yellowish white. Spiracles, soiled yellow with pale brown rims. Abdomen, bright green, spotted with lemon-yellow. Legs, yellow, the terminal segments brown. Prolegs, pale blue-green. Crochets, magenta.

Transversely across the top of the 2nd and 3rd segments there is a raised studded lemon-yellow bar.

Head, bright green, studded with lemon-white dots, and having a pale orange V on the front. Mouth parts, brown. Ocelli, pale brown.

MATURE LARVA. Length, 77 mm. The example measured was probably smaller than the average.

Body ground color, pale green. Scutellum and anal plates, pale blue, studded with white. Caudal horn white, and relatively short. Spiracles, white, with broad orange rims. Legs, pale buff, with brown terminal segments, and covered with short white setae. Prolegs, greenish white. Crochets, mauve, with a fringe of white hairs arching over them.

The diagonal bars described for the first instar, and present in all instars, are now white. In some examples there are purple spots near the ends of the diagonal bars; in others the spots are brown. Predominantly these spots are lacking. They are not shown in our illustration of the mature larva, Plate 1, fig. B.

Abdomen, pale green.

Head. The front is a dull pale chestnut and the remainder a pale bluish green, covered with raised white dots. Mouth parts, black. Ocelli, brown.

When ready to pupate the larvae drop from the tree. Pupation takes place under the soil, usually in late October.

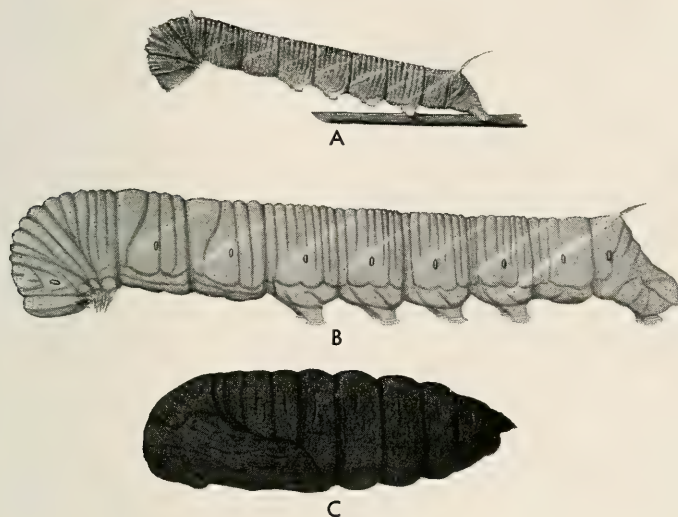


PLATE 1

Larva and Pupa of *Pachysphinx modesta occidentalis* Hy. Edw.

A. Larva, first instar, enlarged approx.  $\times 6$ .

B. Mature Larva, natural size.

C. Pupa, lateral aspect, approx. natural size.

Reproduced from painting by Charles M. Dammers.

**PUPA.** Length, 44 mm. Relatively stout as compared with other sphingid pupae. The cephalic and thoracic elements are well rounded, the latter crowded forward. Color, uniform dark maroon. Our illustration on Plate 1, fig C obviates the necessity of further description.

Larval foodplants: poplar, cottonwood, aspen and willow.

Parasites. *Winthemia quadripustulata* Fab. We bred an unnamed Tachinid from a few of our examples.

#### BIBLIOGRAPHY

of the metamorphosis of *Pachysphinx modesta* Harr

- 1877. Life history. R. Bunker. Canad. Entom. 9: 210.
- 1877. Larva. W. V. Andrews. Psyche. 2: 72.
- 1880. Larva. Coquillett, (quotes Andrews). Trans. Dept. Agr. Ill. 18; Appendix, p. 159.
- 1881. Larva, pupa. D. S. Kellicott Bull. Buffalo Soc. Nat. Sci. 4: 29.
- 1882. Larva. E. B. Reed. 12th Rep. Entom. Soc. Ont. p. 63.
- 1886. Life History. Fernald, (quotes Bunker). Sphingidae. N. Eng. p. 72.
- 1899. Egg, larva, pupa. Soule. Psyche. 8: 308.
- 1921. Egg, larva, pupa. Eliot and Soule. "Caterpillars and Their Moths," p. 174. (fig).

## CALIFORNIA SPECIES OF *SMERINTHUS* WITH NOTES ON THE EARLY STAGES OF *S. CERISYI* *OPHTHALMICUS*

By JOHN A. COMSTOCK AND CHARLES M. DAMMERS

The California representatives of the genus *Smerinthus* are apparently all referable to *cerisyi* Kirby, but represent forms of that species rather than the typical insect.

The most common of these is *Smerinthus cerisyi ophthalmicus* Bvd., characterized by primaries in which the outer two-thirds of the upper surface is a rich mottled brown, and the basal third a light buff or gray-brown.

In Southern California the light color form which was named *pallidulus* by Henry Edwards is equally common. In this form the brown of the primaries is a washed-out light yellow-brown. In both of the above forms the ocellus on the upper side of secondaries is more or less centrally placed on the black field, and is a complete oval.

Mr. Chris Henne mated a pair of typical *ophthalmicus*, the progeny of which were 90% *pallidulus* and 10% *ophthalmicus*. Several workers in Southern California report similar results. Unquestionably these two names represent color phases of the same insect.

We have four examples from Blythe, Calif., in which the ocellus is divided into three portions,—an upper marginal crescent, a central pupil and a lower crescent. These come very close to the figure of *Smerinthus saliceti* as figured by Bruce on Plate 1, Heterocera, Biologia Centrali Americana. *S. saliceti* can therefore be included as one of the races of *cerisyi* occurring in Southern California.

The separation of our western races of *cerisyi* can usually be

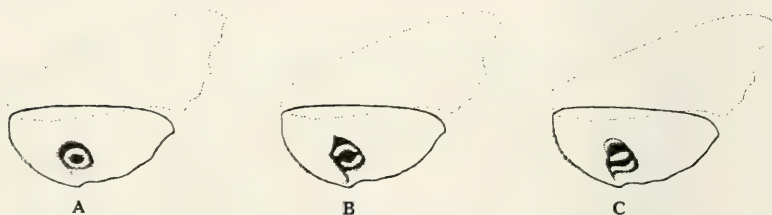


PLATE 2

Outlines of Wings of *Smerinthus*, showing the characteristic ocellus on secondaries in:

A. *S. cerisyi ophthalmicus*. B. *S. cerisyi astarte* Stkr.  
(A Rocky Mountain subspecies) C. *S. cerisyi saliceti*.

Figures approx. natural size.

Drawing by John A. Comstock.

made on the basis of the character of the ocellus. Plate 2 illustrates this.

Dr. McDunnough (in litt.) agrees with us that *pallidulus* should be placed in the list as a form of *ophthalmicus*, and not of *saliceti*. Likewise the aberration *nigrescens* Clark should be placed under *ophthalmicus*. The type of this was taken at Mission San Jose, Calif., so it can also be included for our state.

Although the larva is of common occurrence on willow and poplar, and several writers have published notes on the life history, the sum total of which gives a fairly complete record, there is a deplorable lack of published illustrations.

Dr. Boisduval,<sup>1</sup> in 1869 gave a brief note on the larva, and in 1874<sup>2</sup> published notes on the larva and pupa, with colored figures, but the works cited are exceedingly scarce, and are not available to the average student.

The egg and larval stages were given by Henry Edwards<sup>3</sup> in 1875 in a publication of equal rarity. Prof. French<sup>4</sup> in 1891 described all the larval instars (except the first) and pupa, and Dyar<sup>5</sup> supplemented his paper with a description of the egg and first larval instar.

In 1913 Rowley and Berry<sup>6</sup> published descriptions of the larva and larval habits.

These several authors do not mention the fact that the mature larva occurs in two color phases. We will therefore describe

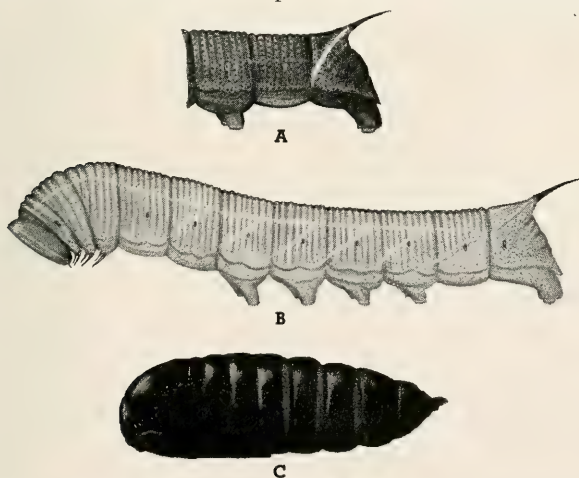


PLATE 3

Mature larva and pupa of *Smerinthus cerisyi ophthalmicus*

- A. Caudal segments of dark form of larva
- B. Light form of larva.
- C. Pupa, lateral aspect.

All figures slightly enlarged.

Reproduced from painting by Charles M. Dammers.



these, and in addition include illustrations of the larva and pupa. (Plate 3.)

MATURE LARVA. Length, 64 mm.

The predominant form is a light bluish green. A rare form occurs which is apple green, and marked quite differently. The latter will be first described.

**DARK FORM.** Body ground color, apple green, heavily speckled with dark green. A pale green longitudinal stripe runs the length of the body immediately above the spiracles. There are no diagonal white bands on the lateral surface, as with the typical form. The eleventh segment alone possesses this diagonal mark. It begins at the base of the caudal horn, runs antero-laterally to the junction of the next segment and there terminates without invading the tenth segment. This diagonal mark is white. (See fig. A of Plate 3.) Caudal horn, dark purple. Abdomen concolorous with remainder of the body. Spiracles, black with white rims, which is the reverse of the pattern on the typical form. Legs, green with brown terminal joints. Prolegs, green with brown crochets.

Head, green, with a white diagonal band along the edge of the cheek.

**BLUISH GREEN FORM.** Body ground color, pale bluish green, heavily speckled with white. A narrow sub-dorsal white stripe runs the length of the body. The fifth to ninth segments are diagonally crossed by narrow white bands. These terminate superiorly at the sub-dorsal stripe. Diagonally across the tenth and eleventh segments there is a narrow lemon-yellow stripe, terminating superiorly at the base of the caudal horn.

Caudal horn, dark purple. Spiracles, white, with black rims. Abdomen concolorous with remainder of body. Legs, mauve, with brown terminal joints. Prolegs, green, the terminal pads and crochets brown.

Head, pale blue, with a lemon-yellow narrow band along the edge of the cheek. (See fig. B of Plate 3.)

Pupation takes place under the soil during October and November.

**PUPA.** Length, 35 mm. The form is somewhat robust, with the head and prothorax well rounded. The surface is profusely pitted. Cremaster, pyramidal, bearing minute punctae. The form is illustrated on Plate 3, fig. C.

The chrysalis overwinters, and emergence occurs the following April or May.

**FOODPLANTS.** Willow, poplar, and possibly aspen.

We have no record of parasites for our western forms, but eastern *cerisyi* is parasitized by *Compsilura concinnata* Meig.

## REFERENCES.

1. Bdv. Lepid. Calif. p. 68, 1869.
2. Bdv. Spec. Gener., Sphingidae, p. 34, Pl. 1, 1874.
3. Hy. Edwards. Proc. Cal. Acad. Sci. April, 1875.
4. French. Canad. Ent 23; 143. 1891.
5. Dyar. Canad. Ent. 23; 200. 1891.
6. Rowley and Berry. Ent. News. 24; 201. 1913.



THE LARVA OF  
*COPICUCULLIA BASIPUNCTA* B. & McD.  
(Lepidoptera)

By JOHN A. COMSTOCK and CHRISTOPHER HENNE

There are apparently no published records of any phase in the metamorphoses of any species in this genus. Fragmentary notes are therefore in order until such time as a more thorough study can be made.

*Copicucullia basipuncta* was first described by Barnes and McDunnough<sup>1</sup> from material taken at Palm Springs, Riverside County.

The junior author first secured larvae on the Quartsite Road, ten miles east of Yuma, Arizona, in 1933. They were feeding on *Stephanomeria runcinata* Nutt., which was growing in a river-wash. These gave forth imagines March and April, 1934.

Subsequently larvae were taken on the same plant near Fenner, San Bernardino County, in May, 1937.

MATURE LARVA; stout, cylindrical, the body tapering on last three or four caudal segments; head slightly smaller than first thoracic segment; texture of body, smooth and glistening.

The body ground color is highly variable, ranging from a light green through intergrading shades to a dark plumb.

There is a narrow mid-dorsal longitudinal yellow stripe, and a substigmatal wider white band, the spiracles placed along its upper edge. Some examples show a slight suggestion of a narrow dorso-lateral longitudinal stripe, very poorly defined.

Abdomen, legs and prolegs concolorous with dorsum. Spiracles, yellow centered, narrowly rimmed with black.

A few short dark setae occur on the body, each one arising from a minute black tubercle.

The head is always (in all color phases) a soiled gray, and is heavily spotted with black dots. A number of black setae occur on it. Ocelli, slaty gray to black.

<sup>1</sup> Cont. Lepid. 4, (2), 100, 1918.

The larva is illustrated on Plate 4.

Pupation occurs under the soil.

This larva has the habit, when disturbed, of violently jerking itself from side to side.

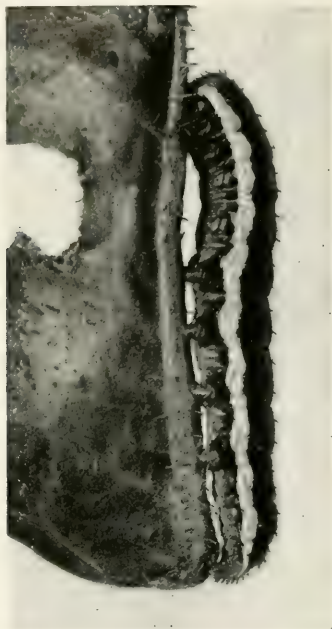


PLATE 4

Mature larva of *Copicucullia basipuncta*.  
Figure slightly enlarged.

Photo courtesy L. A. County Museum



## POLITES SONORA SIRIS EDW. RAISED FROM THE SYNONYMY (LEPID.)

By LLOYD M. MARTIN

Division of Entomology  
Los Angeles County Museum  
Exposition Park, Los Angeles, Calif.

For the past few years various collectors of Lepidoptera have been taking a very dark *Polites* in Mendocino Co., Calif., which did not tally with any species in our Museum collection. After mounting a series of 55 males and 23 females, and prepar-

ing a male genitalic slide, which was submitted to Dr. A. W. Lindsey of Denison University, Granville, Ohio, he was kind enough to determine the species as *Polites sonora* race *siris* Edw.

This race was described by W. H. Edwards as a species, (*Papilio* Vol. 1, No. 4, p. 47, April 26, 1881). We quote in part "From 3 males and 3 females taken at Mount Hood, where it seems to replace *P. mystic*, the nearest allied species." The description fits the Mendocino County specimens very well, with the upper side dark brown over whole of secondaries, apex, and hind margin back to cell and stigma of primaries, with the rest of primaries fulvous.

Harrison G. Dyar in his list of North American Lepidoptera lists *siris* Edw. as from Washington. Dr. Henry Skinner's Synonymic Catalogue of the North American Rhopalocera under No. 517 also states that *siris* Edw. inhabits Puget Sound, Wash.

In Contributions to the Natural History of the Lepidoptera of North America by Dr. William Barnes and Dr. J. H. McDunnough, Vol. 3, part 2, p. 131. Dec. 5, 1916, under *P. sonora* it is stated that "For the species heretofore known as *sylvanoides* Bdv. we must now use the name *sonora* Scud. the type coming from the Sierra Nevada Mts. (Hy. Edw.). *Siris* Edw. described from Puget Sound, Wash. (the original description gives Mt. Hood as type locality, but Morrison later (*Papilio* Vol. 3, p. 43) corrects this) we consider a synonym. The Rocky Mt. form with white spots on the underside of secondaries has been named *utahensis* by Skinner. Wright figures the species as *sylvanoides* (1. c. pl. 31, fig. 425)."

Dr. A. W. Lindsey in "The Hesperionidae of North America North of Mexico," University of Iowa Studies in Natural History, Vol. 9, No. 4, also drops *siris* Edw. as a synonym. "List of Diurnal Lepidoptera" by Wm. Barnes and F. H. Benjamin, Bulletin of the So. Calif. Acad. of Sci., Vol. 25, part 1, 1926, drops *siris* Edw. as a synonym of *sonora* Scud.

From Henry Skinner and R. C. Williams Jr., "On The Male Genitalia of the Hesperiidae of North America," paper 5, from the Transactions of the American Entomological Society Vol. 50, 141-156, No. 852, p. 149, July 21, 1924, we quote in part, "We have specimens from Olympia, Washington, July, and from Castella, Shasta Co., Calif. June (Fox), in which the secondaries below are unusually dark brown with the "cinnamon" tone referred to above, and which run fairly true to color in the series. We therefore retain this name *siris* Edw. as a color form.

Again in the "Hesperioidea of North America," Denison University Bulletin, Journal of the Scientific Laboratories, Vol. 26, p. 103, April, 1931, by A. W. Lindsey, E. L. Bell and R. C.



Williams Jr., under *sonora* the authors state "Siris is brownish below; its retention as a named form is a matter of opinion." Dr. Holland in the 1931 revised edition of the "Butterfly Book," p. 382, gives a very good account of *siris* Edw. but lists it as a species closely related to *sonora*. On pl. 53, fig. 9, is figured an excellent example of *siris*. Comparing it with fig. 10, and 11, of true *sonora*, one can easily see the outstanding differences.

In the "Check List of Lepidoptera of Canada and the United States of America," Part 1, Macrolepidoptera by Dr. J. H. McDunnough, Memoirs of The So. Calif. Acad. of Sci., Vol. 1, 1938, p. 24, *siris* is again listed as a synonym of *sonora*.

In the "Catalogue of the Original Descriptions of the Rhopalocera Found North of the Mexican Border, Part one The Hesperioidea" by Ernest L. Bell; Bulletin of the Cheyenne Mountain Museum, Vol. 1, part 1, p. H26, *siris* is again listed as a race of *sonora*.

It appears, as the above shows, that there has been a decided question as to whether *siris* is too close to *sonora* to be retained as a distinct race, or is just a color form of the species, *sonora*. In studying a long series of *sonora* from Barton Flats in the San Bernardino Mts., Monache Meadows in Tulare Co., Wawona near Yosemite National Park and Shasta Co., California, there remains no question in my mind that *sonora* is the Mountain species ranging from the mountains of southern California north into Oregon. The race *utahensis* Skin. is the very light, Great Basin race ranging from Mono Lake in Mono Co., Calif., through Utah and into western Colorado, *siris* being the north-western race ranging from Puget Sound Washington down and along the coast through Oregon and into Mendocino Co., Calif., (though we have no Oregon records to prove this at present.)

Most of the long series of *siris* from Mendocino Co., were collected by Mr. M. L. Walton of Glendale, Calif. In traveling over the greater part of California in search of new locality records and species he has provided us with a large amount of knowledge of our California lepidoptera.

*P. sonora siris* were found by the author in June 1939 flying in the same vicinity as *Argynnis behrensii* along the coast about two miles south of Manchester, where the wind blows almost continuously. This is the same place where Mr. Walton had taken a long series the year before. We also have two specimens from Point Arena which is a short distance south of Manchester in Mendocino Co.

One probably will find intergradations of *sonora* and *siris* in Western Oregon that will be difficult to separate. There is no question as to the specimens from Mendocino Co. being distinct enough to place *siris* as a coastal race of *sonora*.

## A NEW SUBSPECIES OF ORCHOPEAS SEXDENTATUS (BAKER)

(SIPHONAPTERA: DOLICHOPSYLLIDAE)

By G. F. AUGUSTSON  
Allan Hancock Foundation  
The University of Southern California

During a recent field trip into the Grand Canyon National Park by Dr. John S. Garth, Dr. R. L. Rutherford, and Granville P. Ashcraft for the Allan Hancock Foundation, a fine series of ectoparasites were collected. Among this material are two fleas apparently new to science which are here described and illustrated.

The writer is grateful to Dr. H. C. Bryant, Superintendent, Grand Canyon National Park, for his invitation to the Allan Hancock Foundation thereby making possible the receipt of the above mentioned material, and to Ranger Naturalist Louis Shellback, likewise of the Grand Canyon National Park, for the addition of specimens from the Naturalist Work Shop, Grand Canyon National Park.

Host identification is that of J. C. von Bloeker, Mammalogist, Allan Hancock Foundation, from specimens put up in the field by G. P. Ashcraft.

### FAMILY DOLICHOPSYLLIDAE

ORCHOPEAS SEXDENTATUS NEOTOMAE n. subsp.

#### HOLOTYPE FEMALE

HEAD: frontal notch present, small, sharply acuminate; labial palpi slightly shorter than fore-coxa; maxillae sharply acuminate; preantennal region with two rows of bristles, three usual large bristles in lower row, five in upper, of medium size to somewhat smaller along antennal groove (bristle on immediate margin of gena broken in type): eye conspicuous, darkly pigmented; genal process sharp, somewhat darkly pigmented; post-antennal region with three bristles just beyond middle of posterior antennal groove, two medium bristles above a much larger single bristle.

THORAX, ABDOMEN, AND LEGS: pronotum with nine lone, slender spines on a side; tergum of metanotum with two tergal teeth, first abdominal tergite with two, second with four, third with four; three antepygial bristles, the middle one-third longer than the outer and one-half longer than the inner; style short, its

length not exceeding much more than twice its greatest width, a long terminal bristle with minute dorso-lateral and medium ventro-lateral bristles; sternite VII very diagnostic, a sharp, deep sinus between a broad, blunt upper lobe and a shorter, narrower lower lobe; legs as in other members of the genus.

#### ALLOTYPE MALE

HEAD: as in female, the upper row of bristles in the preantennal region along the anterior antennal groove more conspicuous and larger than in female; bristles in postantennal region all sub-equal.

THORAX, ABDOMEN, AND LEGS: pronotum as in female; tergal teeth as in female, with addition of two on fourth abdominal tergite; two antepygial bristles, the inner twice the length of the outer; moveable finger very diagnostic, close to *O. s. schisintus* (Jordan) but upper free portion very uniform in width on the very long fixed end, four very short spiniforms, the two lower ones close together; sternite IX also characteristic, lower lobe smaller, more angulate than in *O.s. schisintus*, upper lobe rounded dorsally, concave distad; sternite VIII reduced as in other members of the genus; legs as in other members of the genus.

Holotype: a ♀ from *Neotoma lepida devia* Goldman, collected by R. L. Rutherford, South Entrance Grand Canyon National Park, Coconino Co., Arizona, June 5, 1942. Deposited in the Allan Hancock Foundation, University of Southern California, Los Angeles, California.

Allotype: a ♂ collected and deposited with the holotype as above.

Type Host: *Neotoma lepida devia* Goldman.

Type Locality: South Entrance Grand Canyon National Park, Coconino county, Arizona.

Remarks: this new subspecies, as already referred to, is close to *O.s. schisintus* (Jordan). Jordan (1929) in his analysis of new subspecies of *O. sexdentatus* stresses the importance of the length of the terminal segment of the labial palpi as being shorter than the next two above together as a diagnostic feature with this category, but so may *O. wickhami* (Baker)! However, *O.s. neotomae* is readily separated from others of the group by the modified abdominal segments. *O.s. neotomae* is named from the host animal to which it is probably a normal parasite. Illustrations were drawn, under the writer's supervision, by Mr. Anker Peterson, Staff Artist, Allan Hancock Foundation.



1



2

## PLATE 5

Fig. 1. *Orchopeas s. neotomae* Augustson, sternite VII, spermatheca, holotype female.

Fig. 2. *Orchopeas s. neotomae* Augustson, clasper, moveable finger, sternite IX, allotype male.



## A NEW PARASITIC FLY FROM BATS

(Diptera: Pupipara)

By G. F. AUGUSTSON

Allan Hancock Foundation  
The University of Southern California

Recently obtained by the writer from a series of California Leaf-nose Bats (*Macrotus californicus*) are a number of small parasitic flies. These are members of that little known suborder Pupipara. The majority proved to be *Nycterophilina coxata* Ferris, 1916. Besides these interesting forms a *Trichobius* was recovered that appears to be new to science, which is here described and illustrated.

## FAMILY STREBLIDAE

TRICHOBIUS ADAMSI n. sp.

A small species, 1.85 mm. close to *T. mixtus* Curran, 1935.

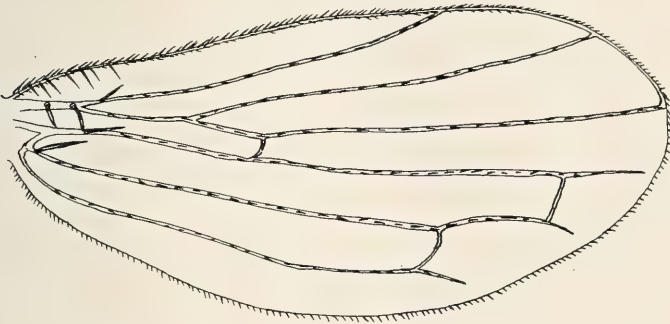
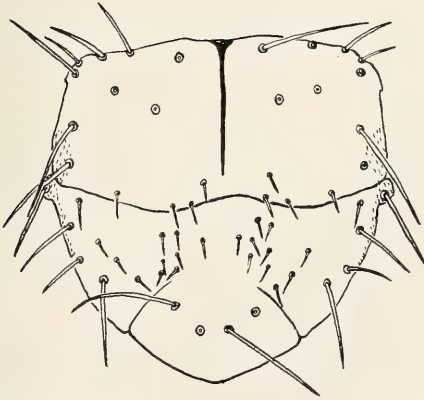
Arista of antenna slender, finger-like, with rays all on one side, equal from base to apex; palpi usual flat shape, extending well beyond anterior margin of head. Femora slender, not broad as in *T. phyllostomae* Kessel. Mesonotum with anterior margin flat; humeral angles strong, with three large bristles; median suture almost reaching transverse suture, the latter bowed upward, disc setulose only on outer, medio-lateral margins, scutellum as in *T. mixtus*. First vein with two strong bristles, second and third with one, fourth with one. Abdomen as in other members of the genus.

Holotype: a ♂ from *Macrotus californicus*. Collected by J. C. von Bloeker, Jr. at Parker, Mohave County, Arizona, on September 22, 1942. Deposited in the Allan Hancock Foundation, University of Southern California, Los Angeles, California.

Allotype: a ♀ from *Macrotus californicus*. Collected by writer 10 mi. S.E. Indio, Riverside County, California. Deposited as above.

Paratypes: two ♂♂ collected and deposited with allotype.

Remarks: host identifications are those of J. C. von Bloeker, Jr., Mammologist, Allan Hancock Foundation. This new species is named in honor of Dr. Lytle S. Adams, to whom the above collectors are indebted for much interesting information and specimens of various bats from Southwestern U. S.

**1****2**

## PLATE 6

Fig. 1. *Trichobius adamsi* n. sp., wing, holotype male.

Fig. 2. *Trichobius adamsi* n. sp., mesonotum, holotype male. (Of greater magnification than the above).

# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

---

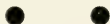
## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS; 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.



### Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1942, including volumes XXIV to XLI, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

### MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939.

# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 1, 1926 .....	2.00	4.00
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50

(Continued on next page)



# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ “ “ printed on one side of page (bound) .....	2.75	4.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published)...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall .....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfami- lies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....	\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....	.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....	3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis .....	.50

ADDRESS ALL INQUIRIES TO  
SOUTHERN CALIFORNIA ACADEMY OF SCIENCES  
(Care DR. JOHN A. COMSTOCK)  
Los Angeles Museum, Exposition Park,  
Los Angeles, California, U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

#### **Form of Legacy**

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of..... Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

#### **Form of Devise**

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.....), here describe the property or ground rent.....), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.









REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# PRINTING

Books • Catalogs • Broadsides  
Stationery and Office Forms



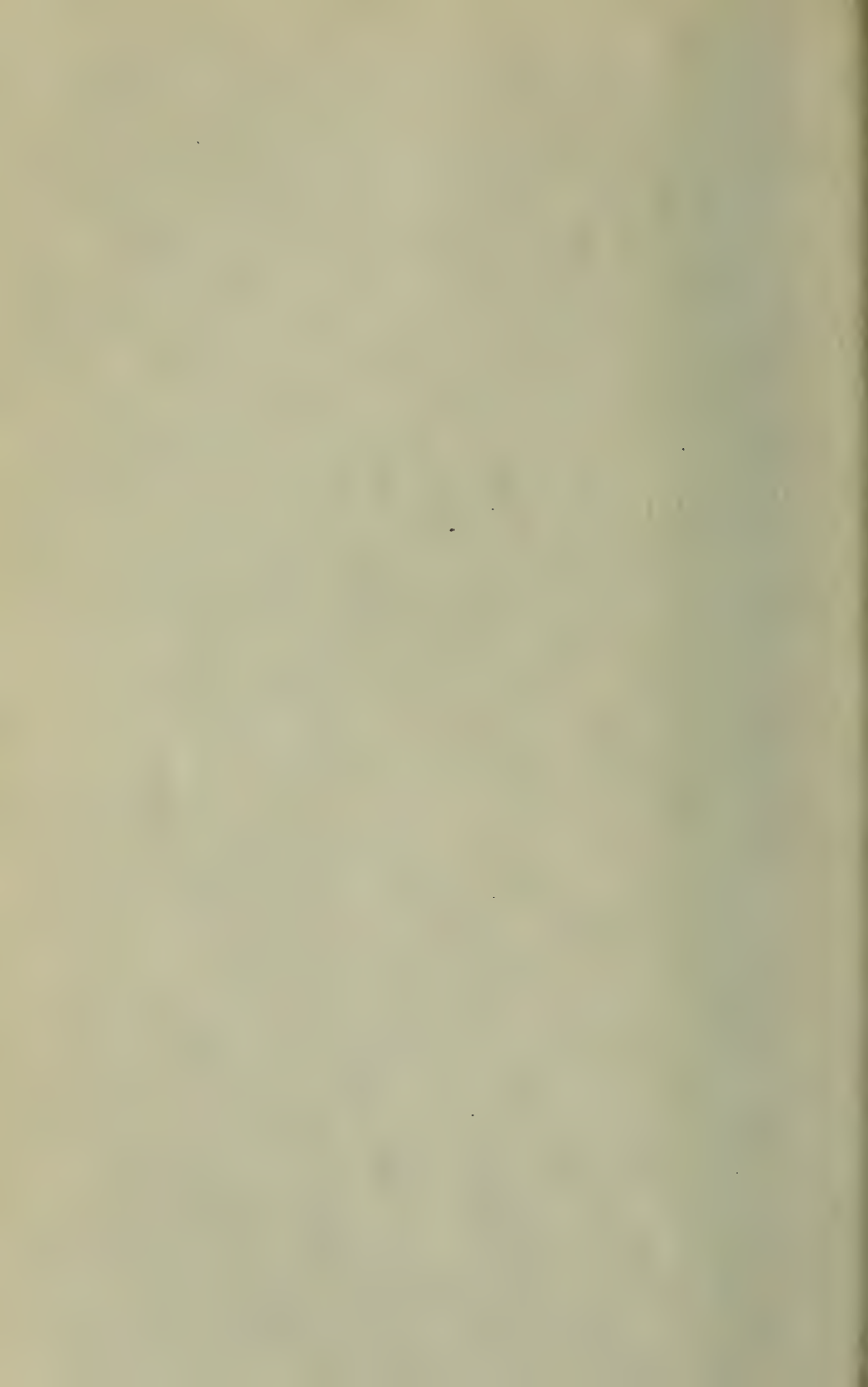
## MCBRIDE PRINTING CO.

PHONE: PROspect 2045

415 EAST ELEVENTH ST.

Los Angeles, California

"Since 1879"



1943  
NEW YORK  
BOTANICAL  
GARDEN

BULLETIN OF THE  
Southern California  
Academy of Sciences

LOS ANGELES, CALIFORNIA

*Nostra tuebimur ipsi.*



VOL. XLII

MAY - AUGUST, 1943

PART 2

CONTENTS

Page

LIFE HISTORY OF PSEUDALYPIA CROTCHI Hy. Edw. (LEPIDOPT.) John A. Comstock - - - - -	59
NOTES ON THE METAMORPHOSIS OF LEPTARTCTIA CALIFORNIAE WLK. (LEPIDOPT.) John A. Comstock and Charles M. Dammers - - - - -	67
PRELIMINARY RECORDS AND DISCUSSION OF SOME SPECIES OF SIPHONAPTERA FROM THE PACIFIC SOUTHWEST—G. F. Augustson - - - - -	69
THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES: No. 15—BIRDS OF EL SEGUNDO AND PLAYA DEL REY Jack C. von Blocker - - - - -	90



# Southern California Academy of Sciences



## OFFICERS and DIRECTORS

DR. W. DWIGHT PIERCE - - - - - *President*  
DR. H. J. ANDREWS - - - - - *First Vice-President*  
DR. WILLIAM L. LLOYD - - - - - *Second Vice-President*  
DR. JOHN A. COMSTOCK - - - - - *Secretary and Treasurer*

DR. H. J. ANDREWS	DR. HOWARD R. HILL
DR. A. WIER BELL	DR. WILLIAM L. LLOYD
MR. FRED E. BURLEW	MR. THEODORE PAYNE
DR. JOHN A. COMSTOCK	DR. W. DWIGHT PIERCE
MR. SAMUEL MOODY HASKINS	DR. ROBERT L. RUTHERFORD
MR. R. S. WOGLUM	



## ADVISORY BOARD

DR. CHESTER STOCK                      DR. R. H. SWIFT



## BOTANICAL SECTION

MR. THEODORE PAYNE, *Secretary*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT

## FINANCE COMMITTEE

MR. FRED E. BURLEW, *Chairman*

MR. SAMUEL MOODY HASKINS

## PROGRAM COMMITTEE

DR. ROBERT L. RUTHERFORD, *Chairman*                      DR. HOWARD R. HILL



## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK, *Chairman*

DR. CHESTER STOCK                      DR. WILLIAM L. LLOYD



## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles, Calif.

## Bulletin, Southern California Academy of Sciences

VOLUME 42 - - - - - PART 2, 1943

LIFE HISTORY OF PSEUDALYPIA  
CROTCHI Hy. Edw.

By JOHN ADAMS COMSTOCK

This exquisite and rare little moth was first described by Henry Edwards<sup>1</sup> from an example taken at Warner's Ranch, San Diego County, Calif. Ten years later the same author described the var. *atrata*<sup>2</sup> in which the creamy white band normally crossing the primaries is entirely lacking. The type was recorded from Los Angeles.

We have examined most of the collections gathered in these two areas in the past decade, and the species was not represented in them, nor have we ever encountered it in our own field work. It may have been more common in the Los Angeles area in the seventies and eighties before the region was so thickly built over. Certainly it is of very rare occurrence at the present time.

Early in 1939 Mr. Chris Henne reported a colony in the region of the Lovejoy Buttes on the Mohave Desert, and supplied a few immature larvae.

We were unable to rear these to maturity.

In April of this year (1943), in company with Lloyd Martin of our Entomological staff, I visited the area, and found the moth on the wing in abundance. It occurred chiefly along the wash or arroyo of Big Rock Creek where its foodplant, *Malvastrum exile* Gray was present.

The first trip was made April 1. The day was reasonably warm and sunny, and *crotchi* were on the wing in fair numbers. They were active and difficult to net, but the females frequently settled on moist sandy spots along the arroyo, where they were easily taken.

Two of these were confined in small glass jars that were fitted with covers of soft bobbinet. A small spray of foodplant and a pledget of gauze containing sweetened water was placed in each jar. The jars, with their captives, were placed in strong sunlight for short periods, with the result that 124 eggs were

<sup>1</sup> Proc. Cal. Acad. Sci., V. 111, 1874.

<sup>2</sup> Papilio, IV. 121, 1884.

secured. These were laid chiefly on the bobbinet covers and not on the foodplant.

The second trip was made on April 12th. On this occasion we were accompanied by Darwin Tiemann in addition to Mr. Martin, both of whom proved most helpful in making careful observations. The day was cloudy and chilly, and few *crotchi* were on the wing. Most of these were males. It was shortly discovered that the females were resting in the tops of a variety of bushes, and that nearly all were freshly emerged. This points rather strongly to the supposition that the larvae seek the sand at the base of these bushes for pupation. In such a situation they would be protected from the strong desert winds, and would not be uncovered or sun-baked during their year-long rest in the pupal state.

Two more females were imprisoned as before, and gave us 63 eggs.

All of the ova proved fertile, and hatched in six days from the time of laying.

Specimens of the foodplant were potted on the ground and moistened with water that had been treated with Vitamin B<sup>1</sup> in proper dilution. As a result, all of the plants reached our laboratory in excellent condition.

Thirteen examples of the newly emerged larvae were selected for day-to-day observation, and were placed individually in small glass vials stoppered with absorbent cotton. Each larva was supplied daily with a fresh leaf of the foodplant. Each moult was recorded, and the head case mounted and dated by Mr. Martin.

The remaining larvae were placed in the improved Henne breeding cage, in lots of ten.

This breeding cage was designed by Christopher Henne of the L. A. County Museum staff. It has a metal base for holding water, a central element for soil, (through which runs a tube that allows the roots of the plant to reach the water) a top cylinder of glass and a removable metal-rimmed gauze cover. This type of cage has many advantages over the usual type. It provides sufficient air for the larvae, and correct humidity for the plant. The central element allows the larva to go down into the soil for pupation without danger of being drowned in the water. The removable lower element allows frequent change of the water without disturbing the plant or the larvae. The glass cylinder gives all around observation.

If the water is reinforced with the proper salts, as advocated in the science of Hydroponics, the plant will remain fresh almost indefinitely.

We used "Plant-chem" for this purpose with excellent results, and our rate of mortality in the larvae was very low.

In the first larval instar we tried the substitution of *Malva parviflora* L. for *Malvastrum exile* but the young larvae did not readily take to it. However, in the later instars they accepted it. While gathering *M. parviflora* in the Baldwin Hills, within the city limits of Los Angeles, Mr. Lloyd Martin found two larvae of *P. crotchii*, which proves that it is native to this area even though it has been entirely overlooked by the present generation of collectors.

The abundance of material for study and the skillful assistance of Mr. Martin in caring for the larvae has made possible the recording of the complete metamorphosis of this species, as follows:

*Egg*: ovate, the base flattened; slightly taller than broad, the surface covered with about thirty nodular ridges. These begin at the base and extend upward towards the micropyle, but several of them coalesce or pinch out near the micropyle. The nodules are confined to the ridges, and do not cross the intervening depression between ridges. Micropyle not depressed, and formed of small sub-hexagonal pits. Color, when first laid, delicate green, gradually changing to ivory. Measurement: .70 mm high by .65 mm broad. The egg is illustrated on Plate 7, fig. A.

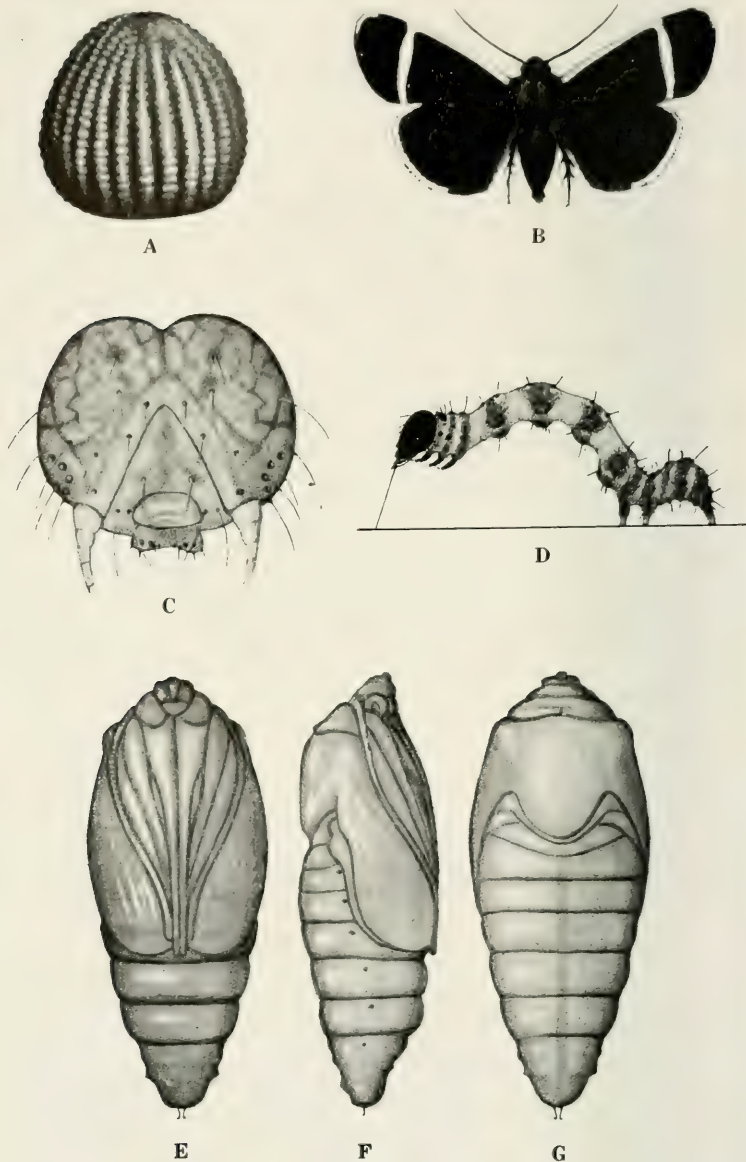
#### LARVA.

*First instar*. Length of Larva, 2 mm. Head, glistening black, wider than body segments, sparingly covered with short black setae. Ocelli, black; antennae white. Head width, .30 to .35 mm.

Body, ground color, dull yellow. There is a dark scutellum on the first segment. The second and third segments are shaded with olive-green. On each typical segment in the dorsal area are two white tubercles, one each side of the median line on each segment. The fourth segment has only one pair of these tubercles placed near the posterior edge of the segment. The fifth, sixth and seventh segments have two pair each, the first pair closer together near the front, the second pair wider apart and near the posterior margin. The caudal segments have a number of paired black tubercles bearing black setae. On the medial edge of each of the white tubercles above described is a black papillus bearing a black seta.

Laterally on each typical segment there is a large translucent tubercle around the margin of which are three black papillae, each bearing a black seta.





## PLATE 7

Metamorphosis of *Pseudalypia crotchii* Hy. Edw.

- A. Egg, magnified X 40  
 B. Moth, enlarged X 2  
 C. Head of mature larva, magnified X 14  
 D. Larva, first instar, magnified X 40  
 E, F, G. Pupa, ventral, lateral and dorsal aspect, enlarged X 5  
 Reproduced from painting by the author.

The central part of each segment is expanded, and brownish black in color, while each segmental juncture is contracted, and is yellow or greenish yellow. This gives the larva a banded and gnarled appearance.

There are a number of small black papillae scattered sparingly over the body, each of which arises from a black papillus with, in some cases, a white circlet at the base. A dark anal plate is present.

Legs, black on the two proximal segments, translucent on distal segment. Prolegs, proximal segment ivory, with a black plate on the outer surface; distal segments ivory, with a black juncture.

Duration of the instar, five to seven days. After moulting the larva consumes its cast off skin. It feeds chiefly at night.

The posture of the larva is characteristic, and persists throughout all instars, but is particularly noticeable in the first. It arches the middle segments, and the head and thoracic segments are held upright. When resting, a fine silken thread is attached to the leaf on which it is standing, the other end being attached to the spinneret. When disturbed, even slightly as by a touch of one of its fellows, it drops on this thread for about an inch, and curls into a ball. This is probably an excellent protection against ants and other predaceous insects, and it is also a safeguard against being blown away from its source of food by the desert winds, which are frequent and strong on the Mojave.

The first instar larva is illustrated on Plate 7, fig. D.

*Second instar.* Length of larva, shortly after moult, 6 mm. Head, dull yellow and gray, blotched with brown and black. Ocelli, black. Head width, .48 to .58 mm.

On the first segment there is a shield-shaped scutellum, bisected in the center by a longitudinal black line, at the side of which is an area of mottled brown. Lateral to this is an area of yellow-gray. The remainder of the segment is mottled dull yellow and dark brown.

The body of the larva is predominantly brownish black, with numerous dashes of soiled yellow. A number of straw colored setae arise from papilliform nodules. Many of the latter have ovate yellow spots in front of or lateral to them.

On the fourth segment there is a large nodular swelling, laterally situated, mottled brown and yellow, on which are placed three black papillae with their accompanying setae. A similar nodular enlargement occurs on the fifth segment, but is somewhat smaller. On the sixth segment a still smaller nodule of the same character occurs.

From the seventh to the tenth segments the lateral area is heavily streaked with longitudinal broken yellow lines.

Spiracles, concolorous with body, rimmed with black.

Legs, black. Prolegs, mottled yellow and blackish brown, the distal segments ivory or straw.

Duration of the instar, three to five days.

*Third instar.* Length of larva, 8 mm.

Head, straw color, mottled with brownish black, particularly over the upper part of cheeks. A number of short setae arise from black tubercles. Mouth parts, light straw. Head width, .80 to .95 mm.

First segment much as in prior instar, with straw colored scutellum bisected by a brownish black mid dorsal band, and with a yellow patch at its lateral edge. A number of long setae arise from this segment and arch over the head.

The ground color of the body is olive brown, with brownish black mottling over the dorsum, with a few broken longitudinal yellow lines, most prominent laterally and over the caudal area. Several long straw colored setae occur on each segment, each of which arises from a large black papillus. Several of the latter have large yellow spots at their bases, placed either laterally or anteriorly.

The fourth, fifth, sixth and seventh segments have prominent warty protrusions, laterally placed. There is a prominent 'hump' in the caudal area.

The larva still has the "gnarled" appearance, with the center of each segment expanded, and the intersegmental juncture constricted.

Abdomen, lighter than dorsum, with the yellow longitudinal lines wider, and less broken. Legs black. Prolegs as in prior instar.

*Fourth instar.* Length of larva prior to subsequent moult, 10 to 12 mm. Head, mottled ochre and light brown. Ocelli, black. Mouth parts, cream. Head width, 1.35 to 1.50 mm.

The larva is now predominantly mottled olive-gray and olive-brown on a ground color of ochre, with numerous dashes and broken lines of yellow. In the stigmatal area there is a longitudinal wavy ochre line, flecked with red-brown. Spiracles, straw, with narrow black margins, and with an areola of yellow external to the margins. The straw colored setae are relatively shorter and less conspicuous than in the prior instar. They arise as formerly from black papillae.

Abdomen, mottled dark and olive brown. Legs, mottled brown or black. Prolegs, concolorous with body.

The pattern and markings approximate those of the final instar rather than the earlier phases.

Duration of the instar, three to four days.

*Fifth Instar.* Length at end of instar, 20 mm.

Head, light yellow, with light brown irregular lines and mottling, as shown on Plate 7, fig. C. Ocelli, black, or olive-black. Mouth parts, nearly white. Antennae, white, and unusually large. Head width, 2.02 to 2.10 mm.

The ground color of body is much as in prior instar, but is slightly darker. There are three conspicuous triangular yellowish marks over the back. The first of these begins on the stigmatal line in the middle of the third segment, extends upwards and backwards to the middle of the fourth segment in the mid dorsal area, where it joins its fellow of the opposite side. The next occupies an equivalent position on the fourth and fifth segments, and the third is likewise developed on the fifth and sixth segments. These triangular areas are not continuous bands with parallel edges, but are formed by a series of irregular spots and broken crenulations more or less in line with each other. Anterior to each of these is a dark triangulate area formed of black spots and crenulate lines on an olive-gray ground. The remainder of the lateral surface of the larva above the spiracles has a ground color of light yellow, covered with numerous orange dots and broken irregular lines.

In the mid-dorsal area there is a double longitudinal line, interrupted in the fourth, fifth and sixth segments, but otherwise fairly continuous.

The abdominal area below the spiracles has a ground color of light yellow on which are placed a number of longitudinal crenulate lines, dashes and dots of a darker shade. As the stigmatal area is approached these become darker and more conspicuous.

Setae, light straw, arising from small black papillae. Legs, light yellow, spotted with ochre. Prolegs, light yellow, spotted and dashed with ochre. Crochets, translucent yellow.

Spiracles, ochre, with narrow yellow-brown margins.

Duration of the instar, ten to twelve days.

The mature larva is illustrated on Plate 8.

The larva maintains its characteristic pose, with the fourth to seventh segments upwardly arched, throughout all of its instars. Its gait is that of a semi-looper.



Pupation occurs in light sandy soil, probably at some distance from the food plant, under a protecting bush. Before pupation the larvae walk aimlessly about for a considerable period of time. A short time before pupation their colors fade perceptibly and they take on a semi-translucent appearance. When their last evacuation occurs the frass is red.



PLATE 8

Mature larva of *Psudalypia crotchii*  
enlarged approximately X 4.

Photo courtesy L. A. County Museum.

The pupa rests in the ground within a delicate cocoon that is made up largely of sand granules held together by adhesive secretion evidently given off by the larva at the time of its last moult, and only slightly reinforced by a few fragile threads of silk.

PUPA. Length, 11 mm. Greatest width, 4 mm. Color slightly darker over the dorsal surface and front of head.

Sub-fusiform, the head comparatively small, antero-ventrally protruded. Wing cases, translucent. Caudal end regularly rounded, terminated by two small recurved cremasteric hooks.

Antenna terminating a little short of the edge of the wings.

Spricles, minute, inconspicuous, and light brown in color.

There is a mid-dorsal light brown stripe running from the posterior edge of the thorax to the cauda. Intersegmental junctures of the abdomen, light brown.

The surface is smooth and glistening, and there are no setae present.

The pupa is illustrated in ventral, lateral and dorsal aspects on Plate 7, figs. E, F, and G.

## NOTES ON THE METAMORPHOSIS OF LEPTARCTIA CALIFORNIAE WLK. (LEPIDOPT.)

By JOHN A. COMSTOCK AND CHARLES M. DAMMERS

## LEPTARCTIA CALIFORNIAE Wlk.

This arctiid moth is probably more variable in color and markings than any other native species. It is almost impossible to find two examples that are exactly alike even in series that have been reared from a single female. As a result, a large number of names given to various color phases have been relegated to synonymy.

The parent species was first named by Walker<sup>1</sup> in 1855. This is the form with yellow and black secondaries. Form *decia* Bdv. has red and black secondaries, and form *dimidiata* Stretch has solid black or black and white secondaries.

Holland<sup>2</sup> states that it "is found in southern California" from which one would infer that its range was limited to that area. It has long been known to have a range extending from Colorado west to the Pacific, and from British Columbia south through the Pacific States to the border. Walsingham's first examples were taken in Oregon. Dyar<sup>3</sup> recorded it from Colorado in 1903, describing the egg and first larval instar, and he

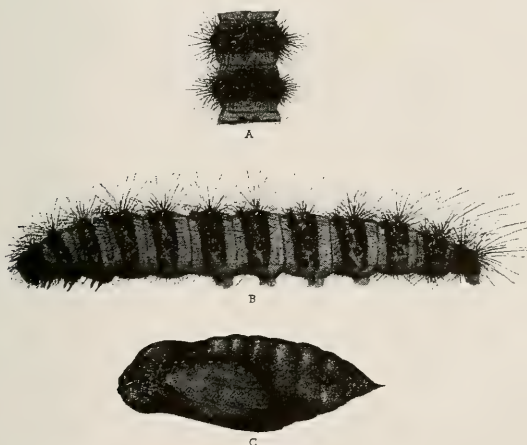


PLATE 9

Larva and pupa of *Leptarctia californiae* Wlk.

- A. Two typical segments of larva, dorsal aspect.
- B. Mature larva, lateral aspect.
- C. Pupa, lateral aspect.

Enlarged X 2½.

Reproduced from painting by Comm. Charles M. Dammers.



PLATE 10

Pupa of *Leptarctia californiae* Wlk., dorsal, lateral and ventral aspects, enlarged X  $2\frac{1}{2}$ .

Photo courtesy L. A. County Museum.

mentions it again in 1904, in his paper on the "Lepidoptera of the Kootenai District."<sup>4</sup> (British Columbia). Llewellyn-Jones reported it from the same province in 1934<sup>5</sup>.

It seems strange that with a species so widely distributed and comparatively common as is *L. californiae*, so little has been published on its early stages. No illustrations of egg, larva or pupa have ever been published to our knowledge.

Prof. French's account<sup>6</sup> written as long ago as 1889 is still the most complete record available, and Dyar's two short notations above referred to are the only other items we have been able to locate in the literature.

Our own breeding experiments lead to the conclusion that the larvae are somewhat more variable than previous accounts indicate.

The foodplants of choice seem to be *Pentstemon* and *Castilleja*, but the species has been reared to maturity on blackberry, dandelion, chickweed, oak, willow, *Ribes aureum* and various species of *Plantago*. Not unlikely it will feed on a great variety of low herbaceous plants.

We find no record of parasites in the literature, and thus far have reared only one,—a species of Ichneumon.

The larva and pupa are illustrated on Plate 9, and three aspects of the pupa on Plate 10.

#### BIBLIOGRAPHY

- <sup>1</sup> Walker. Cat. Br. Mus. 3: 625: 1855.
- <sup>2</sup> Holland. "The Moth Book". 121: 1908.
- <sup>3</sup> Dyar. Proc. U.S.N. Mus. 25: 373: 1903.
- <sup>4</sup> Dyar. Proc. U.S.N. Mus. 27: 794: 1904.
- <sup>5</sup> Llewellyn-Jones. Proc. Ent. Soc. Br. Col. No. 31, P. 30, 1935.
- <sup>6</sup> French. Can. Ent. 21: (11) 210: 1889.

## PRELIMINARY RECORDS AND DISCUSSION OF SOME SPECIES OF SIPHONAPTERA FROM THE PACIFIC SOUTHWEST

By G. F. AUGUSTSON  
Allan Hancock Foundation  
The University of Southern California

### INTRODUCTION

In recent years many fine papers have been published on Siphonaptera of the Pacific coast. The majority of these deal primarily with the central and northern areas (see bibliography). Particularly wanting is a recent and complete report of the distribution and taxonomy of all Western Fleas. It is hoped this need will some day be supplied. To facilitate the recording of material from the Pacific Southwest, records in the writer's files from hundreds of field notes are here recorded in part.

The style followed is somewhat the same as used previously by the writer (1942c). Hosts are given immediately below each parasite that is reported on. To avoid repetition the exact locations are listed separately and referred to after each host recorded by a key number where the writer is the collector, or just preceding the collector's name where it is other than the writer. Then, C-11 will be "Glendale, Los Angeles County, California." A discussion of each parasite is given below its host list. This discussion is composed almost entirely of the opinions of the writer concerning the species for which it is written. The paper concludes with a short summary and a selected bibliography.

Host determinations are the combined efforts of the Mammalogists for the Allan Hancock Foundation and the Los Angeles County Museum; G. P. Ashcraft, K. E. Stager, and J. C. von Bloeker, Jr. The writer wishes to express his appreciation to these scientists, as well as to the many individual contributors of ectoparasitic material to the collection in his care; especially J. C. Couffer, W. H. Doetschman, C. H. Herman, L. C. Ryan, and S. F. Wood.

### LIST OF LOCALITIES

#### Arizona:

##### Cochise County,

1. Dragoon Mountains;

##### Maricopa County,

2. Aztec;

##### Yavapai County,

3. Alvarado Mine;



## Yuma County,

4. Cibola, 30 mi. No. of,
5. El Camino Del Diablo, 2 mi. So. Welton.

## California:

## Imperial County,

1. Indio, 10 mi. S.E. of;

## Kern County,

2. Bakersfield, Lower San Joaquin Valley,
3. Red Rock Canyon, Indian Wells Valley;

## Los Angeles County,

4. Big Pines, San Gabriel Mtns.,
5. Big Tujunga Canyon, San Gabriel Mtns.,
6. Beverly Glen, Santa Monica Mtns.,
7. Castaic, Ventura Mtns.,
8. Chilao, San Gabriel Mtns.,
9. El Segundo, Coast Line,
10. Encino, City of,
11. Glendale, City of,
12. Griffith Park, Santa Monica Mtns.,
13. Hollywood, City of,
14. Lancaster, Antelope Valley,
15. Long Beach, City of,
16. Los Angeles, City of,
17. Newhall, San Gabriel, Mtns.,
18. Pasadena, San Gabriel Mtns.,
19. Playa del Rey Salt Marsh,
20. Pomona, San Gabriel Mtns.,
21. San Gabriel Canyon, San Gabriel Mtns.,
22. San Gabriel Wash,
23. San Fernando Valley,
24. Santa Catalina Island,
25. Sepulvida Canyon, Santa Monica Mtns.,
26. Soledad Canyon, San Gabriel Mtns.,
27. Sunland, City of,
28. Tujunga, City of;

## Orange County,

29. Santiago Canyon, Cleveland National Forest;

## Riverside County,

30. Blythe, Palo Verde Valley, Colorado River,
31. Cabazon, San Gorgonio Pass,
32. Carrizo Creek, Riverside Mtns.,
33. Chino, 10 mi. S.E. Santa Ana River,
34. La Sierra, 15 mi. N. Corona,
35. Lower Colorado River Valley,
36. Morongo Valley, Little San Bernardino Mtns.,

- 37. Palm Springs, Coachella Valley,
- 38. Riverside Mountains, Colorado River,
- 39. San Gorgonio Pass,
- 40. Santa Rosa Mountains,
- 41. Temecula, Temecula Valley;

## San Bernardino County,

- 42a. Pisgah, 40 mi. E. Barstow, San Bernardino Mtns.,
- 42b. Near Big Bear Lake, San Bernardino Mtns.,
- 43. Victorville, Granite Mtns.,

## Santa Barbara County,

- 44. Point Arguello, Santa Ynez Mtns.,
- 45. Santa Barbara, Santa Ynez Mtns.,
- 46. Santa Cruz Island, Santa Barbara Channel,
- 47. Santa Maria, Santa Maria Valley;

## Santa Clara County,

- 48. San Jose, City of;

## San Diego County,

- 49. Borego Desert,
- 50. Del Mar, Coast Line,
- 51. Oceanside, Coast Line,
- 52. Point Loma, Coast Line,
- 53. San Diego, City of;

## Ventura County,

- 54. Frenchman Flats, Piru Creek,
- 55. Rancho Malibu, Coast Line,
- 56. Ventura, City of.

## LIST OF PARASITES AND HOSTS ORDER SIPHONAPTERA

### FAMILY HECTOPSYLLIDAE

*Echidnophaga gallinacea* (Westwood)*Bassariscus astutus* subsp.,

C-38. Collector: K. E. Stager.

*Taxidea taxus neglecta*,

C-41. Collector: C. Henne.

*Vulpes* sp.,

A-4. Collector: J. C. Couffer.

*Vulpes macrotis arsipus*,

C-42a. Collector: J. C. Couffer.

*Urocyon cinereoargenteus californicus*,

C-11. Collector: J. C. Couffer.

*Lynx rufus californicus*,  
C-11. Collector: J. C. Couffer.

*Homo sapiens sapiens*,  
C-16. Collector: T. Lipman.

*Citellus beecheyi* subsp., C-31.

*Citellus beecheyi beecheyi*,  
C-23. Collector: J. B. Cook.

*Citellus beecheyi nudipes*  
C-53. Collector: W. H. Doetschman.

*Citellus tereticaudus chlorus*, C-37.

*Neotoma lepida lepida*, C-37.

*Microtus californicus californicus*, C-44.

*Lepus californicus richardsoni*, C-2.

*Phasianus torquata*, C-51.

*Speotyto cunicularia hypugaea*,  
C-42a. Collector: J. C. Couffer.

DISCUSSION: this parasite has the widest range of hosts in the Pacific Southwest (as it does elsewhere), being equaled in this area perhaps only by *Pulex irritans*.

According to I. Fox (1940b) *E. gallinacea* was given its correct generic assignment by Jordan and Rothschild (1906). Its family arrangement is apparently still in doubt. Jellison and Good (1942) placing it again under Tungidae C. Fox, 1925. Oudemans (Nov. Zool. 16:157) considered Hectopsyllidae Baker, 1904, however, at the same time (p. 158) placed *E. gallinacea* under a new family, Echidnophagidae. The writer can see no reason why the family Tungidae should be used for the above flea, and follows here Ewing (1929), I. Fox (1940).

*Hectopsylla* sp. (near *psittaci* Frauenfeld)

*Bubo virginianus pacificus*  
C-51. Collector: K. E. Stager

DISCUSSION: although thirteen females of the above flea were recovered from a native bird undoubtedly they were originally introduced with the large collection of South American birds at the nearby San Diego Zoo, Balboa Park. Originally in error on the determination of the above fleas the writer now is indebted to Dr. E. A. Chapin, Mr. Glen M. Kohls, and Dr. M. A. Stewart for correction and aid from specimens previously sent to them. Specific identification must remain for further analysis, and possibly the acquisition of male specimens.

## FAMILY PULICIDAE

*Anomiopsyllus falsicalifornicus* C. Fox

*Peromyscus californicus insignis*, C-25.

*Neotoma* sp.,

C-16. Collector: L. C. Ryan.

*Neotoma fuscipes macrotis*, C-6, 25,

C-12. Collector: S. F. Wood.

DISCUSSION: a common parasite of wood rats and associated white footed mice of chaparral areas of northern Los Angeles County and possibly Ventura County.

Jellison and Good (1942) clearly state the synonymy of this flea, and in the same paper include it under the Family Dolichopsyllidae. The writer feels that this arrangement is not satisfactory.

*Anomiopsyllus nudatus* (Baker)

*Peromyscus eremicus fraterculus*, C-22.

*Neotoma* sp., C-29, C-8.

*Neotoma fuscipes macrotis*, C-5.

*Neotoma lepida intermedia*, C-21, 22,

C-5, Collector: J. C. Couffer.

DISCUSSION: this flea apparently reaches its most westerly distribution in the San Gabriel Mountains in the northeast portion of Los Angeles County. It might be mentioned here that both *A. falsicalifornicus* and *A. nudatus* are more commonly encountered in the nest rather than on the host itself.

*Cediopsylla inaequalis interrupta* Jordan

*Didelphis virginianus virginianus*, C-52.

*Urocyon cinereoargenteus californicus*,

C-18. Collector: S. F. Wood.

*Lynx rufus californicus*,

C-11. Collector: J. C. Couffer.

*Lepus californicus* subsp., C-20.

*Sylvilagus audubonii arizonae*, C-14.

*Sylvilagus bachmani cinerascens*, C-20.

C-11. Collector: J. C. Couffer.

DISCUSSION: this parasite has received a fine analysis by Kohls (1940), little can be added here.

*Cediopsylla inaequalis inaequalis* (Baker)

*Sylvilagus audubonii arizonae*, C-14.

DISCUSSION: according to Kohl's distributional chart (1940) this subspecies has never been recorded farther west than Arizona.



Diagnosis of the above record was made from male specimens as well as the previous record (*C.i. interrupta*). These fleas were taken from the same host species from the same locality, but different seasons; *C.i. interrupta* was taken in the spring, *C.i. inaequalis* in the fall. Again, as in many other cases with fleas, we have the question of variations vs. true subspecies.

*Ctenocephalides canis* (Curtis)

*Citellus beecheyi nudipes*

C-53. Collector: W. H. Doetschman.

*Didelphis virginianus virginianus*, C-52.

*Urocyon cinereoargenteus californicus*,

C-11. Collector: J. C. Couffer.

*Canis latrans ochropus*

C-23. Collector: J. Little.

*Homo sapiens sapiens*,

C-16. Collector: L. C. Ryan.

*Ctenocephalides felis* (Bouche)

*Urocyon cinereoargenteus californicus*,

C-11. Collector: J. C. Couffer.

C-18. Collector: S. F. Wood.

*Canis latrans ochropus*

C-23. Collector: J. Little.

*Canis familiaris*,

C-16. Collector: W. Witherspoon.

*Felis domestica*,

C-52. Collector: W. H. Doetschman.

*Lynx rufus* subsp.,

C-53. Collector: W. H. Doetschman.

*Homo sapiens sapiens*,

C-13. Collector: S. F. Wood.

DISCUSSION: as Dampf (1925) has pointed out, this flea is probably a more troublesome domestic parasite than the closely associated *C. canis*.

*Hoplopsyllus anomalus* (Baker)

*Corynorhinus rafinesquii pallescens*,

A-1. Collector: S. F. Wood.

*Citellus beecheyi* subsp., C-54.

*Citellus beecheyi beecheyi*,

C-17. Collector: P. McCabe.

C-18. Collector: E. D. Woodhouse.

*Citellus beecheyi nudipes*

C-53. Collector: W. H. Doetschman.

*Sylvilagus audubonii arizonae*, A-2, C-14.

DISCUSSION: this flea, because of its host association, has received much attention by Public Health workers, consequently its distribution is well known. In the writer's experience he has collected as many specimens from the burrows of its hosts as from the hosts themselves.

*Hoplopsyllus foxi* Ewing*Sylvilagus audubonii arizonae*,

C-35. Collector: K. E. Stager.

*Sylvilagus bachmani cinerascens*, C-20.

DISCUSSION: the common rabbit flea of the Pacific Southwest which also has received fine treatment by Kohls (1940). Ewing (1940) placed it in a new subgenus, *Euhoplopsyllus*, an arrangement which will undoubtedly receive greater attention in time.

*Pulex irritans* Linnaeus*Didelphis virginianus virginianus*, C-52.

C-2. Collector: J. C. Couffer.

*Spilogale gracilis microrhina*, C-22.*Mephitis mephitis estor*,

C-35. Collector: K. E. Stager.

*Mephitis mephitis holzneri*,

C-11. Collector: J. C. Couffer.

*Vulpes macrotis arsipus*,

C-42a, Collector: J. C. Couffer.

*Urocyon cinereoargenteus californicus*,

C-11. Collector: J. C. Couffer.

C-18. Collector: S. F. Wood.

*Canis latrans ochropus*,

C-23. Collector: K. E. Stager.

*Canis mearnsi*,

A-5. Collector: J. C. Couffer.

*Canis familiaris*,

C-11. Collector: J. C. Couffer.

*Lynx rufus* subsp. C-53.*Homo sapiens sapiens*,

C-16. Collector: C. Scherf,

C-13. Collector: S. F. Wood.

*Lepus californicus deserticola*, C-3.

*Odocoileus hemionus californicus*,  
C-45, 56. Collector: C. H. Herman

DISCUSSION: a typical and probably normal parasite on most large native vertebrates in the Pacific Southwest. However, it does not infest human habitations in this area as much as it apparently does elsewhere (Mitzmain, 1909) on the west coast.

*Xenopsylla cheopis* (Rothschild)  
*Oedipomidas geoffravii*, C-55.

*Rattus rattus rattus*,  
C-9. Collector: J. Lewis.

DISCUSSION: this flea, of course, is well known to science, but unfortunately has been neglected in the Pacific Southwest for some time. In the Los Angeles City area nothing much has been done concerning the study of its distribution or presence since the minor plague outbreak of 1924, whereas other great western cosmopolitan areas have, and are continuing, a fine and careful program of studying not only this vector of plague but others as well.

#### FAMILY DOLICHOPSYLLIDAE

*Amphipsylla neotomae* I. Fox  
*Bassariscus astutus* subsp.,  
C-38. Collector: K. E. Stager.

*Spilogale gracilis arizonae*,  
C-32, 38. Collector: K. E. Stager.

DISCUSSION: the writer (1942e) has recently given an analysis of this very interesting parasite.

*Diamanus montanus* (Baker)  
*Mephitis mephitis holzneri*,  
C-11. Collector: J. C. Couffer.

*Citellus* sp.  
C-42a. Collector: J. C. Couffer.

*Citellus beecheyi* subsp., C-8, 34, 54.

*Citellus beecheyi beecheyi*, C-31,  
C-4. Collector: R. C. Swingler.  
C-17. Collector: P. McCabe.  
C-18. Collector: E. D. Woodhouse,  
C-23. Collector: J. B. Cook,  
C-42b. Collector: J. C. Couffer,  
C-54. Collector: J. C. von Bloeker.

*Citellus beecheyi fisheri*, C-29, 43.

*Citellus beecheyi nesioticus*, C-24.

*Citellus beecheyi nudipes*

C-53. Collector: W. H. Doetschman.

*Citellus chrysodeirus bernardinus*,

C-42b. Collector: J. C. Couffer.

*Neotoma* sp., C-29.*Neotoma fuscipes macrotis*, C-12.*Sylvilagus bachmani cinerascens*, C-18.*Homo sapiens sapiens*,

C-13. Collector: S. F. Wood.

DISCUSSION: this parasite is the most common flea found on western ground squirrels and related animals. The writer's record (above) from man is interesting. There are many published notes incriminating this flea as a vector of plague, yet few records where it has been taken directly from man.

*Foxella ignota acuta* Stewart*Thomomys bottae* subsp., C-44,

C-46. Collector: J. C. von Bloeker.

*Dipomys agilis agilis*, C-44.

DISCUSSION: this flea, a recent addition to our fauna, apparently is found on pocket gophers within the immediate coastal area of the Pacific Southwest as far as is known at present.

*Foxella ignota coufferi* Augustson*Thomomys altivalis*,

C-42b, Collector: J. C. Couffer.

DISCUSSION: another recent addition of fleas recorded from pocket gophers. There is no way of knowing its distribution as yet, but the writer would surmise it closely follows that of its host species.

*Malaraeus sinomus* (Jordan)*Onychomys torridus pulcher*, C-37.*Reithrodontomys megalotis longicaudus*, C-5.*Peromyscus crinitus stephensi*, C-37.

A-3. Collector: S. F. Wood.

*Peromyscus eremicus eremicus*, C-37, A-4.*Peromyscus eremicus fraterculus*, C-12, 22.*Peromyscus californicus insignis*, C-5, 21, 31, 44.*Peromyscus californicus sanctidiegi*,

C-17. Collector: J. C. Couffer.



DISCUSSION: the records as presented above should add much to our knowledge of the distribution of this flea. Hubbard's records (1940,6) and statement of the rarity of this flea in the Pacific Northwest agrees well with writer's opinion that it is principally a flea of the Pacific Southwest.

*Malaracus telchinum* (Rothschild)

*Dipodomys* sp., C-45.

*Reithrodontomys megalotis longicaudus*, C-44.

C-47. Collector: J. C. von Bloeker,

C-5. Collector: J. C. Couffer.

*Peromyscus maniculatus gambeli*, C-6, 7, 8, 31, 44.

C-47. Collector: J. C. von Bloeker.

*Peromyscus californicus insignis*, C-5, 12, 21, 28, 31, 44, 50.

*Peromyscus eremicus fraterculus*, C-22,

C-5. Collector: J. C. Couffer.

*Peromyscus boylii rowleyi*, C-21.

*Neotoma* sp., C-29.

*Neotoma fuscipes macrotis*, C-6, 25.

*Neotoma lepida intermedia*, C-21.

*Microtus* sp.,

C-42b. Collector: J. C. Couffer.

*Microtus californicus sanctidiegi*, C-21,

C-5, 33. Collector: J. C. Couffer.

*Microtus californicus stephensi* C-19.

*Rattus rattus rattus*, C-24.

DISCUSSION: although not many records appear in literature on the distribution of this flea in the Pacific Southwest, the numerous records presented above are not surprising. *M. telchinum* has a much greater distribution throughout western North America than *M. sinomus*, the former greatly overlapping the range of the latter.

*Monopsyllus ciliatus mononis* (Jordan)

*Citellus chrysodeirus bernardinus*,

C-42b. Collector: J. C. Couffer.

*Entasias quadrivittatus speciosus*,

C-42b. Collector: J. C. Couffer.

DISCUSSION: the records above greatly extend the known southern distribution of this flea. The writer (1942c) added much

to our knowledge of its host selection from an area close to its type locality, and in a comparison of these to the ones recorded above it is not surprising that this flea does appear much farther south.

*Monopsyllus wagneri ophidius* (Jordan)

*Reithrodontomys megalotis longicaudus*, C-44,  
C-47. Collector: J. C. von Bloeker.

*Peromyscus maniculatus gambeli*, C-31, 44,

C-5. Collector: J. C. Couffer.

C-47. Collector: J. C. von Bloeker.

*Peromyscus maniculatus sonoriensis*, C-31, 37.

*Peromyscus californicus insignis*, C-31.

DISCUSSION: Hubbard's records (1940, 4) again are perhaps of more interest than the above, although the latter further substantiates the opinion of most Siphonapterists that this flea is a coastal subspecies. It is of interest to note here that Jellison and Good (1942) retain the closely associated *M. w. systaltus* only from original records and that of Wagner (1936). The latter record may have been confused with *M. w. wagneri*.

*Nosopsyllus fasciatus* (Bosc)

*Rattus norvegicus norvegicus*

C-53. Collector: W. H. Doetschman.

DISCUSSION: a well known flea because of its importance as a vector of plague (see discussion below *X. cheopis*). Perhaps one point of importance, often overlooked, in regard to this flea's association with plague is its choice of hosts, which may be native rats and mice as well as the domestic ones. The writer is in possession of a recently acquired series of fleas from Coos Bay, Coos County, Oregon, in which this fact has proven quite evident.

*Odontopsyllus dentatus* Baker

*Urocyon cinereoargenteus californicus*,

C-18. Collector: S. F. Wood.

*Neotoma fuscipes* subsp., C-36.

*Sylvilagus audubonii arizonae*, C-14.

*Sylvilagus bachmani cinerascens*,

C-11. Collector: J. C. Couffer.

DISCUSSION: the fine treatment given this species by Kohls (1940) makes it unnecessary to discuss it here.

*Opisodasys nesiotus* Augustson*Peromyscus maniculatus gambeli*, C-44.*Neotoma fuscipes macrotis*, C-44.

DISCUSSION: the recording of the above flea from the Pacific Southwest mainland constitutes its first known presence in this particular area, contradictory to the writer's original belief (unpublished) that it was restricted to the Santa Barbara Channel Islands. Its mainland distribution, so far as is known to date, is apparently restricted to the coastal area only.

*Orchopeas caedens* (Jordan)*Reithrodontomys catalinae*, C-24.*Reithrodontomys megalotis limicola*, C-19.*Peromyscus eremicus fraterculus*, C-26.*Peromyscus californicus insignis*,

C-50. Collector: John A. Comstock.

*Neotoma fuscipes macrotis*, C-25.

DISCUSSION: the status of this species is in doubt according to Wagner (1936). The writer is inclined to agree with Dr. Wagner's suggestion that it may be confused with *O. labiatus*. I. Fox (1940a) definitely established *O. labiatus* as a valid species, a point which never has been questioned but certainly greatly neglected. Unfortunately Jordan's *C. c. durus* (1929) only added to the confusion. The latter subspecies was described mainly from females, which, as Jordan pointed out, have an extremely variable seventh sternite the shape of which alone (excluding chaetotaxy) could include those of *O. caedens*, *O. labiatus*, or *O. nepos*. Furthermore, Jordan's analysis (1929) of the males *C. c. durus* and *C. c. caedens* is inconsistent with his original description of *C. caedens* (1925). The writer retains the arrangement used by I. Fox (1940b).

*Orchopeas dieteri* (C. Fox)*Sciurus griseus anthonyi*,

C-27. Collector: J. C. von Bloeker.

DISCUSSION: the writer considers *O. dieteri* a full species rather than as a subspecies of *O. nepos*, for the same reasons expressed by Dr. I. Fox (1940a, p. 67) in his recombination, which differed from the original assignment by Dr. C. Fox (1929). The above record adds little, except to increase the writer's opinion that *O. dieteri* is one member of the genus which is quite host specific as far as is known to date.

*Orchopeas leucopus* (Baker)*Bassariscus astutus* subsp.,

C-38. Collector: K. E. Stager.

*Peromyscus eremicus fraterculus*, C-31.*Peromyscus californicus insignis*, C-31.*Sigmodon hispidus eremicus*,

C-35. Collector: K. E. Stager.

DISCUSSION: the above records constitute apparently the first Pacific Southwest records of *O. leucopus*. The writer would like to advance here his opinion that its introduction to this area has been with the slow introduction of the cotton rat (*Sigmodon*) into the same area.

*Orchopeas sexdentatus sexdentatus* (Baker)*Mephitis mephitis holzneri*

C-11. Collector: J. C. Couffer.

*Peromyscus eremicus eremicus*, C-40.*Peromyscus maniculatus gambeli*, C-44.*Peromyscus californicus insignis*, C-5, 21.*Peromyscus crinitus stephensi*, C-37.*Neotoma fuscipes macrotis*,

C-11. Collector: J. C. Couffer.

*Neotoma lepida lepida*, C-37, 40,

C-14. Collector: J. C. Couffer.

*Neotoma lepida gilva*, C-31.*Neotoma lepida intermedia*, C-5, 21, 22.

DISCUSSION: unlike *O. caedens* this flea apparently is satisfactorily divided into subspecies. The subspecies recorded above is well known from the Pacific Southwest.

Wagner (1936) in his discussion of *O. s. agilis* apparently is uncertain, and perhaps not in accord with the above statement. He makes a statement (loc. cit. p. 199) which is worthy of consideration here—"The difference in the number of spiniforms on the endopodite which Rothschild took as a character distinguishing *agilis* from *sexdentatus*, is in reality not a peculiarity of *agilis*, but an individual variation, this number (for *agilis*) being different in specimens collected from one and the same *Neotoma*."

In the writer's opinion not so much emphasis is placed on the number of spiniforms of the finger in the males of *O. s. sexdentatus*, and its subspecies, as is the size and shape of the ventral lobe of the ninth sternite. In his own experience little difficulty



was ever encountered in separating the females on the character of their seventh sternite.

*Orchopeas sexdentatus schisintus* (Jordan)

*Neotoma albigula albigula*,

A-3. Collector: S. F. Wood.

DISCUSSION: apparently the inland Pacific Southwest subspecies of *O. sexdentatus*, which, for reasons stated previously, is easily recognized in both males and female specimens from other members of the genus.

*Orchopeas wickhami* (Baker)

*Sciurus niger rufiventer*,

C-10. Collector: J. B. Cook.

*Perognathus californicus dispar*,

*Peromyscus californicus insignis*,

*Peromyscus eremicus fraterculus*,

*Peromyscus boylii rowleyi*,

C-25. Collector: L. C. Ryan.

DISCUSSION: the above records of this flea constitute its second known presence in the Pacific Southwest coastal area. Specimens were first brought in to the writer by L. C. Ryan from a number of native mice (see above). Later material was received from J. B. Cook from the introduced eastern fox squirrel, which undoubtedly accounts for the presence of this parasite here. As this species is well known from a number of hosts in the east (I. Fox, 1940b) it probably will become as well established here.

*Orchopeas latens* (Jordan)

*Citellus beecheyi nudipes*

C-53. Collector: W. H. Doetschman.

DISCUSSION: apparently rather a rare flea, nothing much being known about it except from its original description (Jordan, Nov. Zool. 32: 105). Some siphonapterists are evidently uncertain of its validity as a species. The specimens in the writer's collection are quite distinct from *O. nepos*, *O. caedens*, or *O. dieteri*.

*Oropsylla idahoensis* (Baker)

*Citellus chrysodeirus bernardinus*,

C-42b. Collector: J. C. Couffer.

DISCUSSION: this flea's range southward is greatly extended by the above record, which constitutes its second known presence in the Pacific Southwest.

*Thrassis arizonensis* (Baker)*Citellus* sp.,

C-42a. Collector: J. C. Couffer.

*Citellus leucurus leucurus*, C-37, 39, 40.*Citellus tereticaudus tereticaudus*, C-1.*Citellus tereticaudus chlorus*, C-37.*Onychomys torridus pulcher*, C-37, 40.*Peromyscus californicus insignis*, C-31.

DISCUSSION: in the writer's opinion this flea cannot satisfactorily be divided into subspecies. Besides from the above records, the writer has also seen hundreds of specimens from Arizona (unpublished). Variation does occur in individuals, which is not unusual for the genus (Jellison, 1937, Hubbard, 1941-7a).

*Thrassis gladiolis gladiolis* (Jordan)*Citellus leucurus leucurus*, C-37, 39, 14.

C-32. Collector: K. K. Stager.

*Peromyscus eremicus eremicus*, C-39.

DISCUSSION: Jordan (1929) erected *Th. g. cauducus* to place a flea he received from Idaho. The writer has found *Th. g. gladiolis*, on antelope ground squirrels along with *Th. arizonensis*, the two are readily separated both in male and female specimens.

## FAMILY HYSTRICHOPSYLLIDAE

*Atyphloceras artius* Jordan*Peromyscus californicus insignis* C-5.*Peromyscus eremicus fraterculus*, C-5.*Microtus californicus californicus*, C-45.

DISCUSSION: a little known flea originally described from British Columbia. The above records evidently constitute its first known presence in the Pacific Southwest. There are only female specimens in the collection in the writer's care, all of which are readily separated from other members of the genus by their peculiar seventh sternite (see Jordan, 1933, text. fig. 19).

*Atyphloceras felix* Jordan*Peromyscus boylii rowleyi*, C-21.*Peromyscus californicus insignis*, C-5, 21, 28, 44.*Peromyscus eremicus fraterculus*, C-12.*Peromyscus maniculatus gambeli*, C-5, 6, 44.

*Neotoma* sp., C-29.

*Neotoma fuscipes macrotis*, C-5, 25,  
C-11. Collector: J. C. Couffer.

*Neotoma lepida intermedia*, C-5.

DISCUSSION: this flea is the most common member of the genus encountered in the Pacific Southwest, from which area it was originally described (Jordan, 1933).

*Atyphloceras longipalpus* Stewart

*Spilogale gracilis microrrhina*, C-22.

*Peromyscus californicus insignis*, C-31.

*Neotoma lepida gilva*, C-31.

*Neotoma lepida intermedia*, C-5, 22.

DISCUSSION: this flea, recently described by Stewart (1940), is also easily recognized. Its range, so far as is known to date, apparently is limited to the Pacific Southwest coastal area, overlapping that of *A. felix*.

*Atyphloceras multidentatus* (C. Fox)

*Reithrodontomys megalotis longicaudus*,  
C-47. Collector: J. C. von Bloeker.

*Peromyscus eremicus fraterculus*, C-22.

DISCUSSION: this species is perhaps better known from the central (type locality) and Northwest Pacific coastal areas.

*Ctenopsyllus segnis* (Schonherr)

*Rattus rattus norvegicus*, C-16

C-15. Collector: John S. Garth.

*Mus musculus musculus*, C-16.

DISCUSSION: this common parasite of our domestic rats and mice is too well known to allow any added information here.

*Carteretta carteri* C. Fox

*Perognathus californicus bernardinus*, C-31.

*Perognathus californicus dispar*, C-25.

*Perognathus californicus ochrus*,  
C-47. Collector: J. C. von Bloeker.

*Perognathus fallax fallax*, C-31.

*Peromyscus californicus insignis* C-5.

*Microtus californicus californicus*  
C-47. Collector: J. C. von Bloeker.

DISCUSSION: an easily recognized species. Its favorite hosts apparently being species of pocket mice. Known originally only from females, Jellison (1940) described the allotype male from a wood rat taken in Los Angeles. In the same paper, Dr. Jellison recorded material from various native mice from the Hasting's Natural History Reservation, Monterey County, California, which greatly extended its known distribution.

*Hystrichopsylla gigas dippiei* (Rothschild)  
*Peromyscus maniculatus gambeli*, C-44.

DISCUSSION: this flea has a wide distribution, but, as Wagner points out (1936), is rarely encountered. The collection in the writer's care contains a single male from the above record.

*Meringis cummingi* (C. Fox)  
*Perognathus californicus ochrus*, C-44.  
*Dipodomys agilis agilis*, C-28, C-44.  
*Peromyscus maniculatus gambeli*, C-44.

DISCUSSION: perhaps the most commonly encountered flea on kangaroo rats in the Pacific Southwest coastal area. Hubbard (1940, 5) recorded many specimens from the Pacific Northwest, thereby extending its known range considerably.

*Meringis dipodomys* Kohls  
*Dipodomys deserti deserti*  
C-49. Collector: Mary V. Hood.  
*Dipodomys merriami simiolus*,  
C-37. Collector: J. C. Couffer.  
*Onychomys torridus pulcher*, C-37.  
*Peromyscus maniculatus sonoriensis*, C-37.

DISCUSSION: a flea found commonly on kangaroo rats of desert areas of the Pacific Southwest. There is little difficulty in separating this species from the closely associated *M. arachis*. The writer is in possession of specimens of both species from the same locality in Arizona (unpublished).

*Peromyscopsylla ebrighti* (C. Fox)  
*Peromyscus boylii rowleyi*, C-21.  
*Peromyscus californicus insignis*.  
C-11. Collector: J. C. Couffer.  
C-12. Collector: S. F. Wood.



*Peromyscus eremicus fraterculus*, C-22.

*Peromyscus eremicus eremicus*, C-37.

*Peromyscus crinitus stephensi*, C-37.

DISCUSSION: a flea commonly encountered off white-footed mice particularly from chaparral areas of the Pacific Southwest.

*Stenistomera mohavensis* (Augustson) n. comb.

*Neotoma lepida lepida*,

10 mi. S.E. Mojave, Kern Co., Calif.

Collector: J. C. Couffer.

DISCUSSION: the writer described this species (1942a) originally under the genus *Delotelis*, an arrangement which does not appear satisfactory. This present assignment to *Stenistomera* naturally raises the question of its relation to the single species known to date under this genus, *S. alpina*. No analysis can be given at this time on this question. The writer hopes he will have an opportunity at some future date to make a comparison of the types of these two species.

#### FAMILY ISCHNOPSYLLIDAE

*Myodosylla collinsi* Kohls

*Myotis velifer celifer*,

C-38. Collector: K. E. Stager.

DISCUSSION: evidently a common parasite on the little brown bat (*Myotis*) in the Pacific Southwest. This flea is easily recognized with male specimens but with difficulty with females only.

*Myodopsylla gentilis* Jordan and Rothschild

*Myotis occultus*,

C-30. Collector: S. F. Wood.

DISCUSSION: also an easily recognized species with male specimens, but difficult with females only. Apparently more generally distributed in the Pacific Northwest than in the Southwest.

*Myodopsylla piercei* Augustson

*Corynorhinus rafinesquii intermedius*,

C-46. Collector: G. P. Ashcraft.

*Antrozous pallidus pacificus*, C-46.

C-26. Collector: J. C. Couffer.

C-48. Collector: K. E. Stager.

DISCUSSION: another species formerly thought by the writer to be restricted to the Santa Barbara Channel Islands, here recorded for the first time on our mainland. This flea is easily distinguished from other bat fleas as originally pointed out by the writer (1941b).

*Sternopsylla texana* (C. Fox)

*Eumops perotis californicus*,  
C-16. Collector: K. E. Stager.

*Tadarida mexicana*, C-16.

DISCUSSION: the above records apparently are the first known from the immediate Pacific coastal area. As the first host recorded (*Eumops*) is a year around resident, this flea undoubtedly found its way here, on the migratory *Tadarida*.

### SUMMARY

New flea records to the Pacific Southwest coastal area as included in this report are: *Orchopeas leucopus* (Baker), *Oropsylla idahoensis* (Baker), *Monopsyllus ciliatus mononis* (Jordan), *Atyphloceras artius* Jordan, and *Sternopsylla texana* (C. Fox). Besides these interesting records, the range of many other fleas have been made better known, as well as an increase of our knowledge of their host selection.

Also new additions to our mainland fauna are *Opisodasys nesiotus* Augustson, and *Myodopsylloides piercei* Augustson, two species formerly believed to be limited to the Santa Barbara Channel Islands.

The absence of many western species will be noticed in this report. This may be due in part to the incompleteness of the survey, although, as is evident from the records given here, many localities were established and many hosts examined. In this latter respect it should be noted here that nearly all if not all, hosts were post-mortem examinations. This may or may not be an important factor in collecting fleas. In the writer's opinion it is.

### SELECTED BIBLIOGRAPHY

Augustson, G. F.

1941a A New Geusibia (Siphonaptera: Dolichopsyllidae). Bull. So. Calif. Acad. Sci. 39:203-204.

1941b. Contributions from the Los Angeles Museum Channel Islands Biological Survey. No. 20. Three New Fleas (Siphonaptera). Bull. So. Calif. Acad. Sci. 40:101-107.

1942a. A New Flea from the Mohave Desert (California). Bull. So. Calif. Acad. Sci. 40:138-139.

- 1942b. Some New California Siphonaptera. Bull. So. Calif. Acad. Sci. 40:140-146.
- 1942c. Ectoparasite-Host Records from the Sierran Region of East-Central California. Bull. So. Calif. Acad. Sci. 40:147-157.
- 1942d. The Allotype of *Amphipsylla Neotomae* I. Fox, 1940 (Siphonaptera: Dolichopsyllidae). Bull. So. Calif. Acad. Sci. 41:39-41.
1942. A New Flea of the Genus *Ceratophyilus*. Trans. San Diego Soc. Nat. Hist. 9(37): 437-438.
1942. A New Subspecies of *Foxella Ignota* (Baker) from California (Siphonaptera: Dolichopsyllidae). Bull. So. Calif. Acad. Sci. 41(2): 69-71.
1942. A New Subspecies of *Orchopeas sexdentatus* (Baker) (Siphonaptera: Dolichopsyllidae). Bull. So. Calif. Acad. Sci., in press.
- Dampf, A.  
1925. Ectoparasitos Del Perro, Colectados En Los Meses De Julio a Noviembre De 1924 Por El Servicio De Desinfeccion Y Desinsectizacion Del Departamento De Salubridad Publica De Mexico. Boletin Del Departamento e Salubridad Publica (Mexico). 2:33-42. 4 figs.
- Eskey, C. R. and V. H. Haas  
1939. Plague in the western part of the United States. Infection in rodents, experimental transmission by fleas, and inoculation tests for infection. U.S. Pub. Health Rep. 54(32):1467-1481.
- Ewing, H. E.  
1924. Notes on the Taxonomy and Natural Relationship of Fleas, with descriptions of four new species. Parasitology. 26:341-354.
1940. New North American Siphonaptera. Proc. Biol. Soc. Wash. 53:35-38.
- Fox, C.  
1914. Some New Siphonaptera. U.S. Pub. Health Ser., Hyg. Lab. Bull. 97(1):7-17.
1926. Some New Siphonaptera from California. Pan-Pac. Ent. 2:182-186.
- Fox, I.  
1939. A New Species and Records of Siphonaptera from Mexico. Iowa State Coll. Jour: Sci. 13:335-339.
- 1940a. Notes on North American Dolichopsyllid Siphonaptera. Proc. Ent. Soc. Wash. 42:64-69.
- 1940b. Fleas of Eastern United States. Iowa State College Press. 191 pp., 166 figs.
- 1940c. Siphonaptera from Western United States. Jour. Wash. Acad. Sci. 30:272-275.
- Good, N. E.  
1942. Key to the males of the Genus *Atyphloceras*, with a description of the male of *Atyphloceras echis*. Pan-Pac. Ent. 18:87-89.
- Hubbard, C. A.  
1940. A checklist of the Fleas of the Pacific Northwest. Pac. Univ. Bull. vol. 37, No. 4.

1940. A Review of the Fleas of the Genus *Meringis* with two new species. Pac. Univ. Bull. vol. 37, No. 5.
1941. Ectoparasites of Western Lagomorpha. Pac. Univ. Bull. Vol. 37, No. 8.
1941. The Fleas of rare Western Mice. Pac. Univ. Bull. Vol. 37, No 9A.
- Jellison, W. L.
1939. *Opisodasys* Jordan 1933, a Genus of Siphonaptera. Jour. Parasitology. 25:413-420.
1940. Siphonaptera: Notes on two California Species, U. S. Pub. Health Rep. Mar. 22, 1940, pages 489-492.
- Jellison, W. L. and N. E. Good
1942. Index to the Literature of Siphonaptera of North America. U. S. Pub. Health Ser., Nat. Inst. Health Bull. 178:1-193.
- Jordan, K.
1925. New Siphonaptera. Nov. Zool. 32:96-112.
1929. Notes on North American Fleas. Nov. Zool. 35:28-29.
1929. Two New American Fleas. Nov. Zool. 35:268-269.
1933. Descriptions of Siphonaptera. Nov. Zool. 39:66-69.
1933. A Survey of the Classification of the American Species of *Ceratophyllus* s. lat. Nov. Zool. 39:70-79.
1938. On some Nearctic Siphonaptera. Nov. Zool. 41:119-124.
- Jordan, K. and N. C. Rothschild
- 1915a. Contribution to our knowledge of American Siphonaptera. Ectoparasites, 1:45-60.
- Kohls, G. M.
1937. A New Species of Bat Flea (Siphonaptera) from Arizona. Jour. Parasitology. 23:300-302.
1938. Two New Species of *Meringis* Jordan (Siphonaptera) U. S. Pub. Health Rep. 53:1216-1220.
1940. Siphonaptera: A Study of the Species Infesting Wild Hares and Rabbits of North America North of Mexico. Nat. Inst. Health Bull. 175.
- Mitzmain, M. B.
1909. List of the Siphonaptera of California. Can. Ent. 27:197-204.
- Oudemans, A. C.
1909. Neue Ansichten über Die Morphologie Des Flohkopfes, Sowie Über Die Ontogenie, Phylogenie Und Systematik Der Flöhe. Nov. Zool. 16:133-158.
- Stewart, M. A.
1930. Notes on North American *Ceratophylli* (Siphonaptera). Can. Ent. 62:152.
1930. New Nearctic Siphonaptera. Can Ent. 62:175-180.
1937. A New Thrassis Species (Siphonaptera) from California. Can. Ent. 69:273-274.
1940. New Siphonaptera from California. Pan-Pac. Ent. 26:17-28.
- Vorhies, C. T. and W. P. Taylor
1940. Life History and Ecology of the White-Throated Wood Rat, *Neotoma Albigula Albigula* Hartley, in Relation to Grazing in Arizona. Univ. Ariz. Coll. Agr. Tech. Bull. 86, pages 455-529.
- Wagner, J.
1936. The Fleas of British Columbia. Can. Ent. 68:193-207.



THE FAUNA AND FLORA OF  
THE EL SEGUNDO SAND DUNES

## 15. BIRDS OF EL SEGUNDO AND PLAYA DEL REY

(Part II. Continued from Part 1, p. 30)

By JACK C. VON BLOEKER, JR.

ALLAN HANCOCK FOUNDATION

University of Southern California

Order CUCULIFORMES—Cuckoo-like Birds

Family CUCULIDAE—Cuckoos and Roadrunners

*Geococcyx californianus* (Lesson). Roadrunner

Resident of the meadow and sand dunes. Nests in April and May, usually in patches of cactus (*Opuntia littoralis*). Adult male collected by Willett at Playa del Rey, Dec. 29, 1908, and adult female taken in the meadow by the writer, Feb. 13, 1932. An old, but well preserved, nest of this species was found in the midst of a patch of tuna cactus on the seaward slope of the dunes by G. P. Kanakoff, Oct. 26, 1939.

Order STRIGIFORMES—Owls

Family TYTONIDAE—Barn Owls

*Tyto alba pratincola* (Bonaparte). Barn Owl

Common resident of the meadow, sand dunes, and salt marsh. On numerous occasions individuals of this species were observed at dusk as they flew overhead, sometimes uttering racuous shrieks. They nest from February to early June, but chiefly in March and April. Four to six eggs are laid.

Family STRIGIDAE—Typical Owls

*Speotyto cunicularia hypugaea* (Bonaparte). Burrowing Owl

Common resident of the dunes, meadow, and drier portions of the salt marsh. In the meadow area and on the established fore-dunes, these owls occupy old burrows of the California ground squirrel. In the northern part of the meadow slope of the dunes, near Playa del Rey, they live in cavities excavated under the

pavement. Around the entrances of holes occupied by these birds were found accumulations of detritus, including pellets, droppings, and feathers. Examination of some of the pellets revealed them to contain chiefly the indigestible chitinous remains of insects, such as Jerusalem crickets, mole crickets, grasshoppers, and beetles. Occasionally a few identifiable mammal bones were found and twice remnants of lizards were discovered, once parts of a brown-shouldered lizard (*Uta*) and the other time a head of a horned lizard (*Phrynosoma*). Mammals, represented by skeletal remains, were: pocket mouse (*Perognathus longimembris cantwelli*), harvest mouse (*Reithrodontomys megalotis limicola*), and white-footed mouse (*Peromyscus maniculatus gambelii*).

The burrowing owl nests here from early April to early June. They lay from 4 to 11 eggs, 9 being the usual number.

*Asio wilsonianus* (Lesson). Long-eared Owl

One record: specimen found dead on highway at Playa del Rey, Dec. 31, 1929, by H. N. McCoy. Probably a wanderer into the region.

*Asio flammeus flammeus* (Pontoppidan). Short-eared Owl

Winter visitant in the salt marsh and occasionally in the meadow. An adult female collected at the latter place by the writer, Feb. 13, 1932.

Order MICROPODIIFORMES—Swifts and Hummingbirds

Family MICROPODIDAE—Swifts

*Aëronautes saxatilis saxatilis* (Woodhouse).

White-throated Swift

Winter visitant in small flocks throughout this region. Flock of twenty seen foraging above the meadow, Feb. 13, 1932; about 30 observed foraging above the dunes and out over the ocean, Nov. 3, 1939; group of six noted flying above the salt marsh, Dec. 2, 1941.

Family TROCHILIDAE—Hummingbirds

*Archilochus alexandri* (Bourcier and Mulsant).

Black-chinned Hummingbird

Found fairly common in April, 1932, around flowers of tree tobacco (*Nicotiana glauca*) at the meadow base of the dunes and at the edge of the salt marsh. Adult male collected in the meadow, April 9, 1932, by the writer.

*Calypte costae* (Bourcier). Costa Hummingbird

One record: adult male collected in the meadow at tree tobacco, Apr. 17, 1932, by the writer.

*Calypte anna* (Lesson). Anna Hummingbird

Common resident of the dunes, meadow, and willow thickets of the salt marsh. Frequently observed feeding at flowers of tree tobacco and eight specimens collected in this association six in the meadow at the base of the dunes and two at the edge of the salt marsh.

*Selasphorus rufus* (Gmelin). Rufous Hummingbird

Common migrant. Adult male collected at tree tobacco in the meadow area, April 17, 1932, by the writer.

*Selasphorus alleni alleni* (Henshaw). Allen Hummingbird

Common migrant. An adult male was secured while it was feeding at flowers of tree tobacco in the meadow area, April 9, 1932, by the writer.

## Order CORACIIFORMES—Kingfishers, etc.

## Family ALCEDINIDAE—Kingfishers

*Megaceryle alcyon caurina* (Grinnell)  
Western Belted Kingfisher

Resident of the salt marsh and commonly forages along shore between Playa del Rey and El Segundo. An adult female taken at Hyperion, Oct. 15, 1917, by Wyman, and an adult male collected at the same locality, Feb. 13, 1932, by the writer. May nest in the palisades at Playa del Rey, but this is not definitely known.

## Order PICIFORMES—Flickers, Woodpeckers, etc.

## Family PICIDAE—Flickers, Woodpeckers, and Sapsuckers

*Colaptes cafer collaris* (Vigors). Red-shafted Flicker

Resident of the sand dunes, meadow, and willow bottoms of the salt marsh. Frequently noted on the ground, feeding on ants. Also eats aphids, beetles, grasshoppers, crickets, cicadas, etc. Nests in a variety of situations as, in holes in willows or in telegraph poles, and in corners under eaves of old houses. Nesting season extends from late April to mid-June, four to five eggs being laid in a set. Four specimens collected in the meadow area by the writer.

## Order PASSERIFORMES—Perching Birds

Family TYRANNIDAE—*Tyrant Flycatchers**Tyrannus verticalis* (Say.). Western Kingbird

Summer resident of the meadow, sand dunes, and salt marsh in small numbers. Breeds in May and June; 4 to 5 eggs laid in a set. Adult male collected by Wyman at Hyperion, June 12, 1916.

*Sayornis nigricans nigricans* (Swainson). Black Phoebe

Resident in small numbers on the sand dunes, meadow, and salt marsh. A frequent visitor around human dwellings and often seen in vicinity of Ballona Creek, near Playa del Rey. Breeds from March to June, but most commonly in May. From 3 to 6 eggs are laid in a set and two broods may be raised annually.

*Sayornis saya saya* (Bonaparte). Say Phoebe

Winter visitant in small numbers in the meadow, sand dunes, and salt marsh. Occasionally seen foraging on the shore. An adult male collected by the writer, Feb. 13, 1932, on the meadow slope of the dunes. Frequently observed in the salt marsh in winter, 1931. One individual observed on Hyperion pier, Oct. 26, 1939.

## Family ALAUDIDAE—Larks

*Otocoris alpestris actia* (Oberholser). California Horned Lark

Common resident of the dunes and meadow area; also found in the drier, open portions of the salt marsh. Five specimens taken at Hyperion in January and February by Wyman. Adult male caught in mouse-trap set in the meadow, May 1, 1932. Additional specimens taken in latter locality in Oct., 1931, and Feb. and Apr., 1932, by the writer.

The breeding season is quite long, extending from March to June. Three to four eggs constitute a set and usually two broods are raised annually.

## Family HIRUNDINIDAE—Swallows

*Stelgidopteryx ruficollis serripennis* (Audubon)

## Rough-winged Swallow

Irregular visitant in this region. One specimen taken at Hyperion, July 6, 1911, by F. S. Daggett. Occasionally observed in spring in vicinity of Playa del Rey and Ballona Creek.

*Hirundo erythrogaster* (Boddaert). Barn Swallow

Common spring and fall migrant throughout this region. Rarely seen in summer in the salt marsh area.



*Petrochelidon albifrons albifrons* (Rafinesque)  
Cliff Swallow

Abundant summer resident from April to early October. Many were found building their mud nests on the side of a bridge across Ballona Creek, April 15, 1929. At El Segundo and Playa del Rey, occupied nests on the sides of buildings have been noted in May and June. From 4 to 6 eggs are laid in a set and two broods may be raised annually.

Family CORVIDAE—Jays, Magpies, Crows and Ravens

*Corvus corax sinuatus* (Wagler). American Raven

Fairly common resident. Often observed in flight over the beach, sand dunes, meadow, and salt marsh. Not known to nest in El Segundo - Playa del Rey region but in former years, at least, nested near Santa Monica (Willett, 1933, p. 117).

*Corvus brachyrhynchos hesperis* (Ridgway). Western Crow

Moderately common resident, though not known to breed in this region. Occasional flocks observed in flight over salt marsh. Seen in the meadow only once when, on April 17, 1932, a flock of about 30 were noted in a grain-field just northeast of El Segundo.

Family PARIDAE—Titmouses, Verdins and Bush-tits

*Psaltiriparus minimus minimus* (Townsend). Least Bush-titi

Resident of the brush-covered slopes of the sand dunes and in the willow bottoms of the salt marsh. Breeds chiefly in April and May. On May 1, 1932, a nest containing 6 eggs was found about four feet above the ground in a bush on the meadow slope of the dunes. In the breeding season, the birds are paired off; during the rest of the year they travel in small flocks of from 10 to 30 individuals.

Family CHAMAEIDAE—Wren-tits

*Chamaea fasciata henshawi* (Ridgway). Pallid Wren-tit

Resident of the brush-covered portions of the dunes and meadow. Breeds in April and May. Three to five eggs are laid in a set, four being the commonest number. An adult male was collected on the meadow slope of the dunes, Feb. 13, 1932, by the writer.

Family TROGLODYTIDAE—Wrens

*Troglodytes aëdon parkmani* (Audubon). Western House Wren

Moderately common summer resident in the brushy portions of the sand dunes and meadow, occasional in winter. Adult male taken Feb. 26, 1919, at Hyperion by Willett (Willett Coll.).

*Thryomanes bewickii correctus* (Grinnell). San Diego Wren

Fairly common fall and winter visitant in the sand dunes, meadow, and in willow bottoms of the salt marsh. Three specimens collected in the meadow by the writer, one each on Oct. 26, 1931 (caught in mouse-trap), Feb. 13, and Mar. 6, 1932.

*Telmatodytes palustris plesius* (Oberholser).

## Western Marsh Wren

A fairly common migrant and winter visitant in the salt marsh. An adult female taken Dec. 20, 1931, at Playa del Rey by P. E. Trapier.

*Telmatodytes palustris paludicola* (Baird). Tule Wren

Common resident of the salt marsh; in fall and winter ranges out into the meadow and on the meadow slope of the dunes. Nests in tule patches, along edges of ponds and sloughs from April to June, but chiefly in May. Usually builds two or more "fake," or dummy, nests before the one in which the eggs are laid. From 4 to 6 eggs comprise a set. Specimens examined as follows: Playa del Rey—13 taken Dec. 8, 1915, by F. S. Daggett; 2 taken Dec. 20, 1931, by P. E. Trapier; 1 caught in mouse-trap Jan. 24, 1932, and another (Allan Hancock Foundation), Oct. 29, 1941, by the writer. El Segundo—2 caught in mouse-traps, Oct. 26, 1931, and March 6, 1932, by the writer (Playa del Rey specimens from salt marsh sloughs, El Segundo specimens from the meadow).

*Salpinctes obsoletus obsoletus* (Say). Rock Wren

Resident of the established fore-dune area at El Segundo and along cliffs at Palisades del Rey. Occasionally seen on top of the sand dunes. Nests in small holes and crevices in banks of solid ground, chiefly in April and May.

## Family MIMIDAE—Mockingbirds and Thrashers

*Minus polyglottos leucopterus* (Vigors). Western Mockingbird

Resident throughout this region. A frequent visitor in yards and around houses, apparently enjoying association with man. Nests chiefly in April and May, four eggs comprising a normal set. Specimens collected by the writer, as follows: in the meadow, Oct. 25, 1931; on the meadow slope of the dunes, Nov. 1, 1931, and on the established fore-dune, Feb. 13, 1932.

*Toxostoma redivivum redivivum* (Gambel). California Thrasher

So far, observed only in fall and winter in brushland areas of the sand dunes and meadow. One specimen caught in rat-trap, Oct. 25, 1931, on the meadow slope of the dunes.

## Family TURDIDAE—Thrushes, Bluebirds, etc.

*Turdus migratorius propinquus* (Ridgway). Western Robin

Irregular winter visitant, noted chiefly in yards and on lawns around buildings in this region. An adult male found dead on a lawn near El Segundo was given to me by a small boy, Feb. 13, 1932.

*Hylocichla guttata guttata* (Pallas). Alaska Hermit Thrush

Moderately common winter visitant to brush-covered portions of the dunes and meadow. One specimen collected by the writer in the meadow, Feb. 13, 1932.

(It is quite likely that among the hermit thrushes observed in this region, there were representatives of the Dwarf Hermit Thrush, *Hylocichla guttata nanus* (Audubon), and the Monterey Hermit Thrush, *Hylocichla guttata slevini* (Grinnell). However, as the only available specimen for positive identification is the one mentioned above, it seems better to leave these latter two races out of consideration for the present.)

*Sialia mexicana occidentalis* (Townsend). Western Bluebird

Occasional winter visitant in this region. Two specimens were collected from a flock of seven in the meadow, Feb. 13, 1932, by the writer.

*Myadestes townsendi* (Audubon). Townsend Solitaire

Rare straggler in winter. One seen by L. E. Wyman at Hyperion, Feb. 9, 1921 (Schneider, 1921, p. 149; Willett, 1933, p. 134).

## Family SYLVIIDAE—Gnatcatchers, Kinglets, etc.

*Polioptila caerulea amoenissima* (Grinnell)

Western Gnatcatcher

Moderately common fall and winter visitant throughout brush-covered portions of the sand dunes and meadow.

*Corthylio calendula cinerascens* (Grinnell)

Ruby-crowned Kinglet

Common winter visitant on meadow slopes of the dunes, in the brushy portion of the meadow, and in the willow bottoms of the salt marsh. Also frequently found in trees and shrubbery in vicinity of houses.

## Family MOTACILLIDAE—Wagtails and Pipits

*Anthus spinoletta rubescens* (Tunstall). American Pipit

Common winter visitant in the meadow, on the established fore-dunes, along roadsides and highways, and in more open portions of the salt marsh.

## Family LANIIDAE—Shrikes

*Lanius ludovicianus gambeli* (Ridgway). California Shrike

Moderately common resident throughout this area. Nests chiefly from March to May, four eggs being the usual number in a set. Preys chiefly on large insects (crickets, grasshoppers, cicadas, beetles, etc.), arachnids, lizards, and small rodents. A young horned lizard (*Phrynosoma*) was found impaled on a sharp-pointed branch of a *Croton californicus*, Oct. 26, 1939, by Mrs. D. Pool. Apparently it had been left there by a shrike. Eight specimens taken by the writer, 3 in fall, 1931, 2 in spring and 1 in summer, 1932, and 2 in winter, 1939-40, in the meadow area.

## Family VIREONIDAE—Vireos

*Vireo huttoni huttoni* (Cassin). Hutton Vireo

Occasional winter visitant in the brushy portion of the sand dunes and in the willow thickets of the Playa del Rey salt marsh. Also found in shrubbery and trees around houses. An adult male taken Dec. 5, 1931, on the meadow slope of the dunes by the writer.

## Family COMPSOTHYLPIDAE—Wood Warblers

*Vermivora celata lutescens* (Ridgway). Lutescent Warbler

Fairly common spring and fall migrant in the sand dunes and salt marsh, occasional in winter. An adult male was collected Jan. 8, 1934, in the salt marsh by G. G. Cantwell.

*Vermivora celata sordida* (Townsend). Dusky Warbler

Common fall, winter, and spring visitant in brushy areas of the dunes and meadow, and in willow thickets of the salt marsh. An adult male was collected in the salt marsh, Feb. 7, 1934, by G. G. Cantwell, and an adult female on the meadow slope of the dunes, Feb. 13, 1932, by the writer.

*Dendroica auduboni auduboni* (Townsend). Audubon Warbler

Abundant winter visitant throughout this region. It has been frequently observed on the strand, foraging for kelp flies. Usually appears in this general region in October and remains until April.

*Dendroica townsendi* (Townsend). Townsend Warbler

Fairly common spring and fall migrant, occasional in winter. An adult male was collected Feb. 13, 1932, in a natural basin on the seaward slope of the dunes by the writer.



*Geothlypis trichas scirpicola* (Grinnell). Tule Yellow-throat

Common resident of the salt marsh, occasional in winter in the meadow. Nests in tule patches along sloughs and ponds in the salt marsh in April and May. Four eggs comprise a normal set. Juvenal female taken in the salt marsh, June 16, 1929, by G. G. Cantwell; adult male and female, Dec. 20, 1931, and adult male and two females, Feb., 1932, collected in same area by P. E. Trapier; adult male taken in the meadow, Feb. 13, 1932, by the writer.

*Wilsonia pusilla chryscola* (Ridgway). Golden Pileolated Warbler

Two records: Adult female collected by G. G. Cantwell, May 15, 1929, at Playa del Rey, and adult male by the writer, Feb. 13, 1932, at El Segundo (meadow).

## Family PLOCEIDAE—Weaver Finches

*Passer domesticus domesticus* (Linnaeus). English Sparrow

An introduced species, though undoubtedly arrived here by natural infiltration. Abundant resident about human dwellings at El Segundo and Playa del Rey. Breeds from March to July, raising two or more broods annually.

## Family ICTERIDAE—Meadowlarks, Blackbirds, etc.

*Sturnella neglecta* (Audubon). Western Meadowlark

Common resident of the meadow and in drier portions of the salt marsh. Occurs in fairly large flocks in winter. Nests here chiefly in April and May. Three to five eggs are laid in a set. Specimens collected in the meadow by the writer, Oct. 25, 1931, and Feb. 13, 1932.

*Agelaius phoeniceus neutralis* (Ridgway). San Diego Red-wing

Formerly a common resident of tule patches in the salt marsh sloughs, now much less common. Occasionally seen foraging in grain-fields near the meadow area. Four specimens examined from the salt marsh: two females taken Dec. 8, 1915, by F. S. Daggett, and two males taken Feb. 25, 1932, by P. E. Trapier.

*Icterus cucullatus nelsoni* (Ridgway). Arizona Hooded Oriole

Common spring migrant, going inland to nest. An adult male collected by the writer, April 17, 1932, in the meadow.

*Icterus bullockii* (Swainson). Bullock Oriole

Common spring migrant and fairly common summer resident of the sand dunes, meadow, and willow bottoms of the salt

marsh. Also frequents the vicinity of human habitations. Breeds from latter part of April to early June. Five eggs comprise the usual set, rarely six are laid. Specimens were collected by the writer, April 18, and 30, 1932, in the meadow, and June 5, 1932, from willows in the salt marsh.

*Euphagus cyanocephalus* (Wagler). Brewer Blackbird

Common resident throughout this area, individuals even having been seen foraging on the strand. Breeds in April and early May, usually nesting in ornamental trees in the region. Four to six eggs comprise a set.

*Molothrus ater obscurus* (Gmelin). Dwarf Cowbird

One record: an adult male collected by the writer, Feb. 13, 1932, on top of the sand dunes at El Segundo.

Family THRAUPIDAE—Tanagers

*Piranga ludoviciana* (Wilson). Western Tanager

Fairly common spring migrant on sand dunes and in willow thickets of salt marsh. Three adult males collected by the writer, April 30, 1932, on the meadow slopes of the sand dunes.

Family FRINGILLIDAE—Finches

*Hedymeles melanocephalus* (Swainson). Black-headed Grosbeak

Moderately common summer resident in willow bottoms of the salt marsh and along Ballona Creek. Occasional in spring in the meadow. Nests chiefly in May. Two to four eggs comprise a set, three being the usual number. An adult male was collected in the meadow, April 18, 1932, by the writer.

*Guiraca caerulea salicarius* (Grinnell).

California Blue Grosbeak

One record: An adult male in breeding plumage, collected by G. G. Cantwell, June 16, 1929, in the willow thickets of the salt marsh.

*Carpodacus mexicanus frontalis* (Say). House Finch

Abundant resident throughout this region. In winter, occurs in large flocks in the meadow and on the dunes; also, very common in vicinity of buildings. Breeds from April through June, two or more broods being raised annually. Sets comprise 3 to 6 eggs, usually 4 or 5.

*Spinus tristis salicamans* (Grinnell). Willow Goldfinch

Common resident, nesting in the willows of the salt marsh and along Ballona Creek chiefly in May and June. Found commonly in small flocks almost anywhere in this region during rest of year. Four to five eggs comprise a set. Two specimens were collected by the writer in the meadow, one each on Feb. 13, and Apr. 30, 1932.

*Spinus psaltria hesperophilus* (Oberholser)  
Green-backed Goldfinch

Moderately common winter visitant in the brushy portions of the dunes and meadow, and in willow thickets of the salt marsh. An adult male was collected from a flock of about fifteen on the meadow slope of the dunes, Feb. 13, 1942, by the writer.

*Pipilo fuscus crissalis* (Vigors). California Brown Towhee

Fairly common resident of brush-covered portions of the dunes and meadow; occasional about human dwellings. Breeds chiefly in April and May. Two to five eggs comprise a set, but usually there are only 3 or 4. Seven specimens were caught in small traps set for rodents on the meadow slope of the dunes and in the meadow between Aug. 15, 1931, and April 10, 1932.

*Passerculus sandwichensis alaudinus* (Bonaparte).  
Western Savannah Sparrow

An abundant winter visitant in the salt marsh, meadow, and sand dunes. Five were caught in mouse-traps set on the meadow slope of the dunes and in the meadow between Oct. 16, 1931, and April 10, 1932, and two were captured in the same way in the salt marsh, Jan. 24, 1932, and Nov. 1, 1941.

*Passerculus sandwichensis brooksi* (Bishop).  
Dwarf Savannah Sparrow

One record: An adult female was collected by G. G. Cantwell, Feb. 27, 1932, in the Playa del Rey salt marsh.

*Passerculus sandwichensis beldingi* (Ridgway)  
Belding Marsh Sparrow

Abundant resident of the salt marsh; occasionally wanders out onto beaches. An adult female was taken June 4, 1917, at Hyperion by Wyman. Six specimens were collected by the writer, July, 1928, Jan., and Feb., 1932, and Oct., 1941, in the salt marsh.

*Passerculus sandwichensis rostratus* (Cassin)

## Large-billed Sparrow

Common winter visitant in the salt marsh and along the seaward slope of the dunes. Two specimens were trapped in the latter area, Oct. 26, 1939.

*Chondestes grammacus strigatus* (Swainson)

## Western Lark Sparrow

One record: An adult male was collected by the writer, Aug. 15, 1931, in the meadow.

*Amphispiza belli belli* (Cassin). Bell Sparrow

Two records: An adult female collected by Wyman, July 16, 1917, at Hyperion; and an adult male collected by the writer, Aug. 22, 1931, on top of the sand dunes at El Segundo.

*Zonotrichia leucophrys gambelii* (Nuttall). Gambel Sparrow

Abundant winter visitant throughout the region. Earliest date in fall observed in the meadow area by the writer, September 19; latest, in spring, April 30. Several specimens were collected in the salt marsh, meadow, and on the sand dunes in the winter of 1931-32.

*Zonotrichia coronata* (Pallas). Golden-crowned Sparrow

Fairly common winter visitant in the meadow, in brushy parts of the dunes, and around edges of the salt marsh. Specimens were collected on the dunes in October and November, 1931, and in the meadow in February, 1932, by the writer.

*Melospiza lincolnii lincolnii* (Audubon). Lincoln Sparrow

Moderately common winter visitant, occurring most abundantly in the salt marsh. Two specimens were collected by the writer: adult female, Oct. 26, 1931, in the meadow; adult male, Mar. 13, 1932, in the salt marsh (both caught in mouse-traps).

*Melospiza melodia cooperi* (Ridgway). San Diego Song Sparrow

Common resident of the dunes, meadow, and salt marsh. Breeds chiefly in April and May. Three to five eggs constitute a set, four being most common. Two males in breeding condition were taken May 25, and another June 16, 1929, in the salt marsh by G. G. Cantwell. Four specimens taken in the salt marsh, six in the meadow, and one on the seaward slope of the dunes by the writer.



## SUMMARY

This report, the result of a study of the avifauna of the Playa del Rey - El Segundo region, reveals the presence of 185 species and subspecies of birds within the limits of the area considered. At no time, probably, have all the various forms been represented there at once, nor is it likely that they ever will be. In this regard, it has been shown that 29.7 per cent are present throughout the year, the residents (including both breeding and guest species); 6 per cent, only in summer (often including spring and fall); 34.1 per cent, only in winter (also often including fall and spring); 15.6 per cent, only in spring or fall (usually both); and 14.6 per cent are of irregular status, being present only occasionally and, even then, not always returning in the same season as when present before, if at all. It is apparent, from these figures, that the times of greatest avian population, both as regards kinds and individuals, are in the spring and fall seasons (i.e., during migrations). -

As concerns the environmental aspect of the bird-life, five easily recognized major habitat divisions are discussed. These are: the ocean, the ocean shore, the sand dunes, the meadow, and the salt marsh. It was indicated that some of these would, as a result of more detailed study, merit finer analysis. For each major habitat, an associational list of the birds is presented—with qualifying terms as to exclusive, maximum, minor, and seasonal occurrence of each kind in that particular habitat. Irregular visitants are eliminated from these lists as having no particular significance on the association as a whole.

In the accounts of species, all forms are included for discussion. In each account, facts are given as to: general occurrence (where possible), annual cycle of activity (where known), material examined (where available), and citations of published records (where necessary).

## LITERATURE CITED

BICKNELL, F. T.

1924. Golden plover on the southern California coast. *Condor*, vol. 26, pp. 77-78.

CHAMBERS, W. L.

1914. Hooded merganser near Los Angeles. *Condor*, vol. 16, p. 92.

EWAN, J.

1928. California black rail in Los Angeles County. *Condor*, vol. 30, p. 247.

GRINNELL, J.

1898. Birds of the Pacific slope of Los Angeles County. *Pasadena Acad. Sci.*, publ. 2, pp. 1-52.

1906. Pacific kittiwake in southern California. *Condor*, vol. 8, p. 57.

## LAW, J. E.

1915. Franklin gull: a new record for California. *Condor*, vol. 17, p. 96.

## MICHENER, H.

1928. Minutes of Cooper Club meetings: southern division, September (1927). *Condor*, vol. 30, pp. 131-132.

## MILLER, L. H.

1914. Some notes on sea birds from Los Angeles County, California. *Condor*, vol. 16, pp. 40-41.

## PIERCE, W. D., and POOL, D.

1938. The fauna and flora of the El Segundo sand dunes.  
1. General ecology of the dunes. *Bull. So. Calif. Acad. Sci.*, vol. 37, pp. 93-97.

## SCHNEIDER, F. B.

1921. The season: Los Angeles region. *Bird-Lore*, vol. 23, pp. 149-150.  
1923. The season: Los Angeles region. *Bird-Lore*, vol. 25, pp. 408-409.  
1924. The season: Los Angeles region. *Bird-Lore*, vol. 26, pp. 425-427.  
1925. The season: Los Angeles region. *Bird-Lore*, vol. 27, pp. 347-349.  
1926. The season: Los Angeles region. *Bird-Lore*, vol. 28, pp. 147-149.  
Occurrence of Sabine gull at Playa del Rey. *Condor*, vol. 28, p. 178.  
1927. The season: Los Angeles region. *Bird-Lore*, vol. 29, pp. 63-65; pp. 438-439.  
Invasion of the southern California coast by elegant terns. *Condor*, vol. 29, p. 71.  
1928. The season: Los Angeles region. *Bird-Lore*, vol. 30, pp. 23-24; pp. 281-283.

## STEVENSON, J.

1932. Bird notes from southern California. *Condor*, vol. 34, p. 229.

## WILLETT, G.

1912. Birds of the Pacific slope of southern California. *Pac. Coast Avif.*, no. 7, pp. 1-122.  
1933. A revised list of the birds of southwestern California. *Pac. Coast Avif.*, no. 21, pp. 1-204.

## WYMAN, L. E.

1916. Notes from the vicinity of Los Angeles. *Condor*, vol. 18, p. 203.  
1918. Notes from southern California. *Condor*, vol. 20, p. 192.  
1919. Notes from southern California. *Condor*, vol. 21, pp. 172-173.  
1924. The pectoral sandpiper in southern California. *Condor*, vol. 26, p. 36.

# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,  
Los Angeles, Calif., U. S. A.

---

## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

●      ●

## Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1942, including volumes XXIV to XLI, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

### MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939.

# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 1, 1926 .....	2.00	4.00
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50

(Continued on next page)



# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ “ printed on one side of page (bound) .....	2.75	4.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published)...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall .....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfam- ilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....	\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....	.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....	3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis .....	.50

ADDRESS ALL INQUIRIES TO  
SOUTHERN CALIFORNIA ACADEMY OF SCIENCES  
(Care DR. JOHN A. COMSTOCK)  
Los Angeles Museum, Exposition Park,  
Los Angeles, California, U. S. A.

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# P R I N T I N G

Books • Catalogs • Broadsides  
Stationery and Office Forms



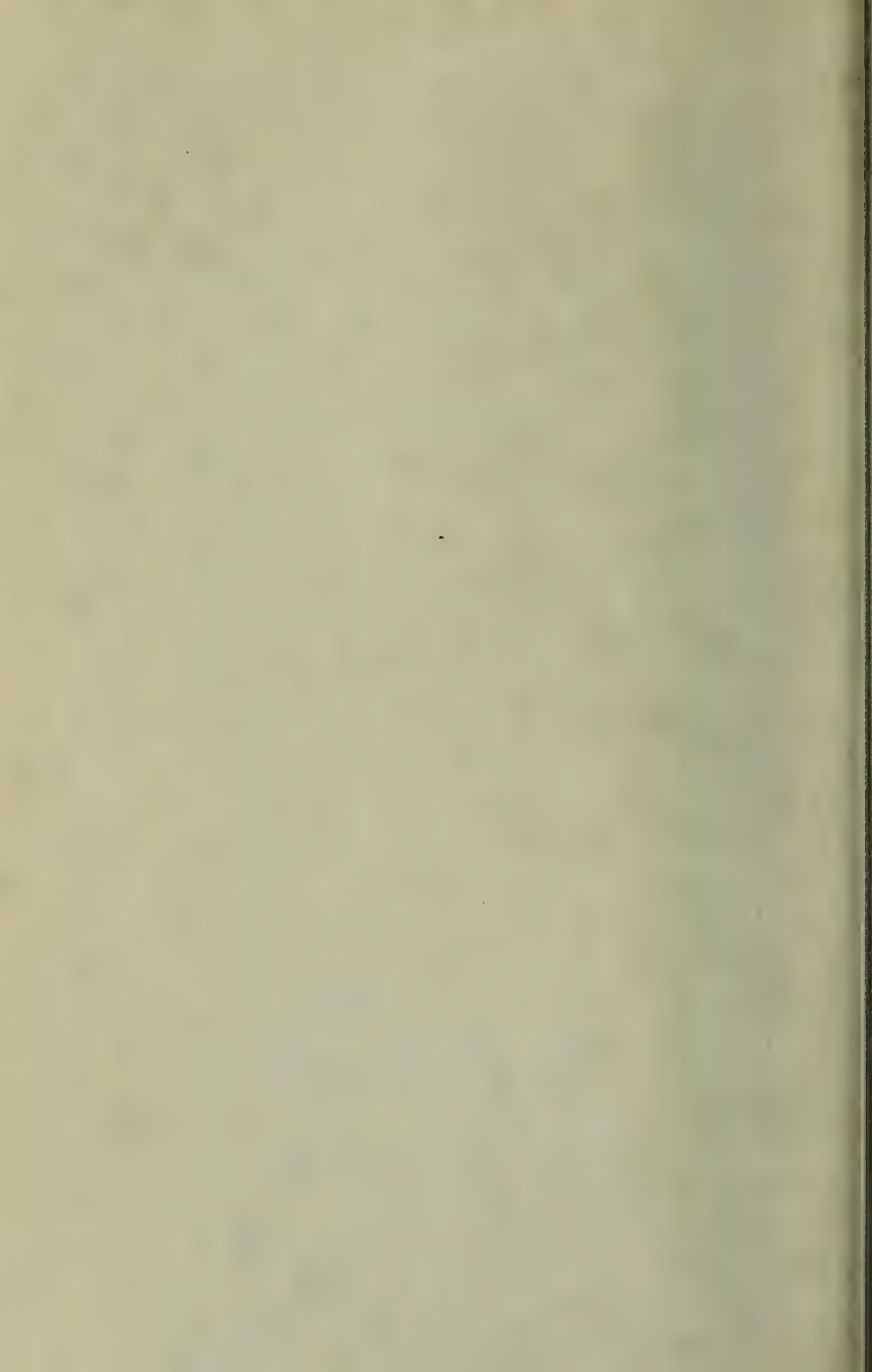
## McBRIDE PRINTING CO.

PHONE: PROspect 2045

415 EAST ELEVENTH ST.

Los Angeles, California

*"Since 1879"*



# BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

*Mostra nobiscum ipsi.*



VOL. XLII

SEPT. - DEC., 1943

PART 3

## CONTENTS

*Page*

### NORTHWEST AMERICAN SPECIES OF GLYCIMERIS:

G. Willett - - - - - 107

### ADDITIONAL NOTES ON THE PERSISTENCE OF TRYPANOSOMA CRUZI IN DEAD INSECT VECTORS:

Sherwin F. Wood - - - - - 115

### THE LIFE HISTORY OF POLITES SABULETI BDV.:

V. G. Dethier - - - - - 123

### MATURE LARVA OF GRAPTOLITHA LONGIOR SM.:

John A. Comstock and Christopher Henne - - 132

### ADDITIONAL NOTES ON ERINNYIS ELLO L.:

John A. Comstock - - - - - 133

### IN MEMORIAM. FORDYCE GRINNELL JR.

- - - - - 136



# Southern California Academy of Sciences



## OFFICERS and DIRECTORS

DR. W. DWIGHT PIERCE - - - - - *President*

DR. H. J. ANDREWS - - - - - *First Vice-President*

DR. WILLIAM L. LLOYD - - - - - *Second Vice-President*

DR. JOHN A. COMSTOCK - - - - - *Secretary and Treasurer*

DR. H. J. ANDREWS

DR. HOWARD R. HILL

DR. A. WIER BELL

DR. WILLIAM L. LLOYD

MR. FRED E. BURLEW

MR. THEODORE PAYNE

DR. JOHN A. COMSTOCK

DR. W. DWIGHT PIERCE

MR. SAMUEL MOODY HASKINS

DR. ROBERT L. RUTHERFORD

MR. R. S. WOGLUM



## ADVISORY BOARD

DR. CHESTER STOCK

DR. R. H. SWIFT



## BOTANICAL SECTION

MR. THEODORE PAYNE, *Secretary*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT

## FINANCE COMMITTEE

MR. FRED E. BURLEW, *Chairman*

MR. SAMUEL MOODY HASKINS

## PROGRAM COMMITTEE

DR. ROBERT L. RUTHERFORD, *Chairman*

DR. HOWARD R. HILL



## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK, *Chairman*

DR. CHESTER STOCK

DR. WILLIAM L. LLOYD



## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif.

NORTHWEST AMERICAN SPECIES OF  
GLYCIMERIS

By G. WILLETT

There appears to be considerable confusion among west coast shell collectors regarding the names of local species of the genus *Glycimeris*. During a current study of Pleistocene mollusks, among which was a considerable number of examples of this genus, the writer found himself unsatisfied as to the applicability of some of the names in general use. It was decided, therefore, to devote some time to a study of the group, in order to ascertain, so far as possible, the number of forms known to occur in our fauna and the names to be applied to them. The following is a resume of the results of this study.

Dr. W. H. Dall (Bull. 112, U.S.Nat.Mus.) ascribes five species of *Glycimeris* to the Recent fauna of our northwest coast. These are:

- G. septentrionalis* Middendorff—Alaska,
- G. subobsoleta* Carpenter—Aleutian Islands to Puget Sound,
- G. corteziana* Dall—Forrester Island, Alaska, to Cortez Bank, California,
- G. migueliana* Dall—Oregon to Lower California,
- G. multicostata* Sowerby— (?) Monterey to South America.

Two additional species, *G. profunda* Dall, and *G. barbarentsis* Conrad, described from the Pleistocene or Pliocene of southern California, require comment here.

The first of the above species, *G. septentrionalis*, has been purportedly figured by Arnold (Mem. Calif. Acad. Sci., III, 1903; pl. 18, fig. 10), and Grant and Gale (Mem. S. Diego Soc. Nat. Hist., I, 1931; pl. 1, figs. 21a, 21b), and described by the former author (op. cit.: 101). Arnold's description was quoted verbatim by Oldroyd (Stanford Univ. Publ. Geol., I, 1924: 41), consequently has been used as a guide by most west coast collectors. Through the courtesy of Dr. U. S. Grant IV, the writer has been permitted to examine Middendorff's description and figures, both of which are good, and it becomes apparent at once that Middendorff's species is very different from what was figured by Arnold, and Grant and Gale, and described by the former. These differences will be discussed later under the species heading.

*Glycimeris subobsoleta* Carpenter was described by that author as *Axinaca* (? *septentrionalis*, Midd. var.) *subobsoleta*. It was not figured by him, but was later by Oldroyd (op. cit.: pl. 40, figs. 8, 9). Grant and Gale erroneously ascribed Arnold's figure (op. cit.: pl. 18, fig. 9) of "*barbarensis* Conrad" to this species.

*Glycimeris corteziana* Dall has been figured only by Oldroyd (op. cit.: pl. 3, fig. 7), in a poor representation, hardly indentifiable. *G. miqueliana* Dall still remains unfigured. *G. multicostata* Sowerby (Proc. Zool. Soc. London, 1833: 195) is almost certainly not a member of our fauna, so will not be considered here.

Although some authors (the writer included) have suggested that this group may have been overnamed and that some of the species listed by Dall should probably be placed in the synonymy of others, the present study has unearthed little evidence to support such a view. It has, however, suggested that a confused situation has arisen through a lack of understanding of differentiating characters, which has resulted in a rather general misapplication of names. Among the reasons for this has been the fact that some identifications received by collectors from authorities of such eminence that their opinions were accepted without question, have proved to be erroneous. For example, two species of *Glycimeris* taken by the writer on Forrester Island, Alaska, and sent to a well-known museum for identification, were returned with the names *corteziana* Dall and *miqueliana* Dall. A little later, in a published account, these species were ascribed to the Forrester Island fauna and the record has been quoted since in other publications. Furthermore, the specimens so identified have been used in the study of others received for naming. It now appears that both of the above species were misidentified, and that neither is entitled to a place in the Forrester Island fauna.

Undoubtedly the factor that causes the most difficulty in distinguishing the different kinds of *Glycimeris* is the great amount of individual variation within the species. This applies not only to the shape, color and sculpture, but to the number of teeth, width of hinge-plate, width of ligamental area, and size and prominence of the umbos. Also there may be considerable morphological change between juvenility and maturity. There is often more similarity between the young of different species than there is between the adults; therefore, many young specimens are very difficult, if not impossible to identify.

In times gone by, too many namers of species have confined their efforts to a description, and omitted any comparison with closely related forms. By listing some of these differentiating characters, as well as by illustrating previously unfigured or

poorly figured species, the writer hopes to help students of this difficult group.

Appreciation is expressed to the U. S. National Museum, through Dr. Paul Bartsch, for illustrations of Dr. Dall's types, and to Dr. U. S. Grant for the loan of the volume of *Malacologica Rossica* containing Middendorff's descriptions; also to the California Academy of Sciences, through Dr. Leo G. Hertlein, and to John Q. and Tom Burch for use of pertinent material from their collections.

### ACCOUNTS OF SPECIES

*Glycimeris septentrionalis* (Middendorff) (Pl. 11, figs. 1, 1a). Middendorff's original description is as follows (parts of the discussion in German omitted):

*Pectunculus septentrionalis* n. sp. Taf. XXI, fig. 1-3. Testa alba, extus maculis intense rubido-fuscis, intus macula ejusdem coloris magna ad impress. musc. antic.; subcordiformi, subaequilaterali, latitudine longitudinem aequante, gibbosa, umbonibus nonnihil antice inflexis; costis interstitia, ob incrementi strias squamulosa, latitudine bis ad ter superantibus, rotundo-applanatis, 37 (7 21 9); dentibus cardinis 22 ad 23; margine medio, dentibus subbifidis grosse dentato.

Die Massverhältnisse sind:

Long., 29 m.; Latit., 30 m.; Diam. ventr., 20 m.

Etwa 37 Rippen kommen vor, von denen ich 21 ausgebildete auf dem Mittelfelde, nebst 7 und 9 etwas schwächeren auf dem sehr undeutlich begrenzten Vorder—und Hinterfelde zählte. Die rundrückigen scharfbegrenzten Rippen sind etwas flach, kaum halb so hoch als breit, und durch Furchen untereinander geschieden, welche zwei bis drei Mal schmaler sind; als die Rücken der Rippen. Den Rippen des Mittelfeldes entsprechend ist der Rand mit groben, der Länge nach gefurchten Zähnen besetzt.

FUNDORT: Die Insel Ukamok an der Nordwerdküste Amerikas (Wosness.). (Middendorff, *Mal. Rossica*, 3, 1849: 583-584).

The "round-backed, sharp-edged ribs, separated by depressions," mentioned in the description and well illustrated in the figure, serve to distinguish this shell from all other known northwest American species of the genus. The writer has not seen this species, nor has he been able to place the type locality definitely, though "Insel Ukamok" might be Ugamak Island, in Unimak Pass. Specimens labelled *septentrionalis* in west coast collections are almost certainly misidentified.



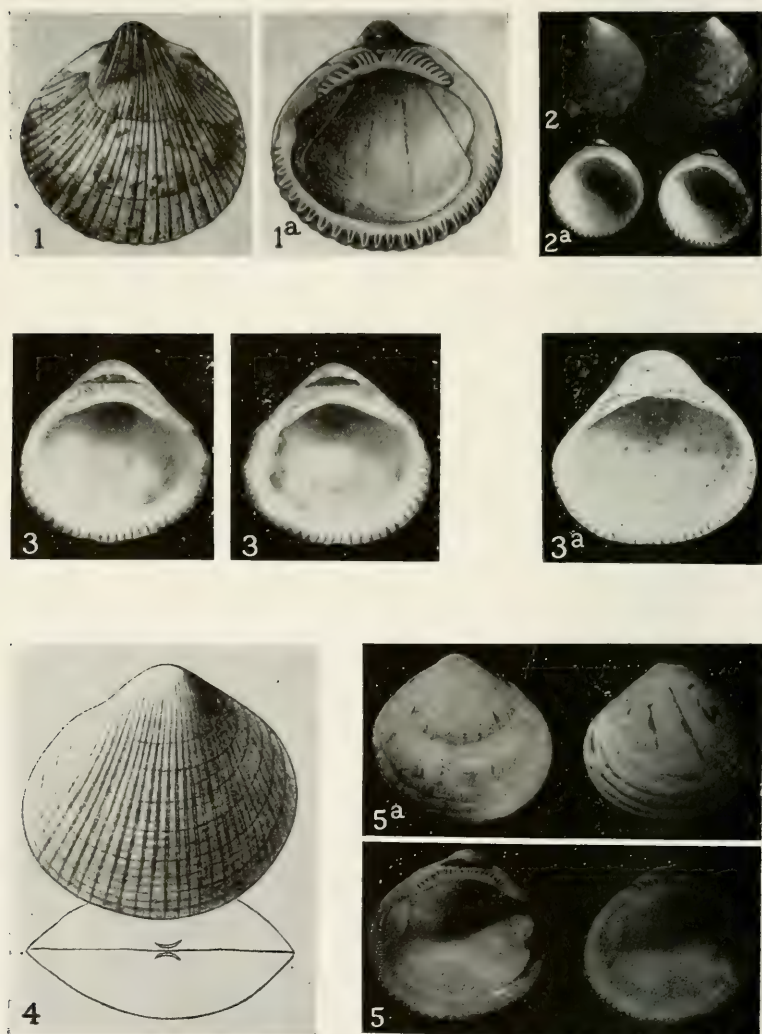


PLATE 11

1, 1a. *Glycimeris septentrionalis*, type (copy of Middendorff's figure); 2, 2a. *G. corteziana* Dall, type, X2; 3. *G. profunda* Dall, off Redondo, Calif. (Burch coll.); 3a. Same, San Pedro (Pleist.); 4. *G. barbarensis*, type (copy of Conrad's figure); 5, 5a. *G. migueliana* Dall, type.

*Glycimeris subobsoleta* (Carpenter) (Pl. 12, figs. 1-3).

The commonest species of the genus along our coast, ranging from the Aleutian Islands to Lower California, and from near low tide line to at least 40 fathoms; also occurring in various Pleistocene deposits in southern California. The *flattest* and *thinnest* of our *Glycimeris*. Typical form (from northern waters) with posterior margin well produced, rendering it considerably longer than high; diameter not much more than half of length. Hinge-plate and ligamental area variable, but averaging considerably more narrow than in next species; umbos small, projecting little, if any, over area; apical angle considerably greater than a right angle. The largest specimen at hand measures: Length, 31; alt., 29; diam., 14.5 millimeters.

A large series of specimens in the California Academy of Sciences, taken in 22 fathoms on Cordell Bank, about 20 miles off Point Reyes, Marin County, California, is quite typical of *subobsoleta*, though perhaps averaging very slightly rounder than Alaskan shells. Off southern California, however, a morphological change in the species begins to be noted. Many specimens are as high as long, with posterior margin slightly, or not at all produced, and with the apical angle about a right angle. Although light in weight, the shell is often less flat than northern specimens, the diameter being about two thirds the length. The extreme of this variation is exhibited in the Upper Pleistocene of upper Newport Bay mesas. The fauna of these fossil deposits is distinctly Lower Californian, and the writer has little doubt that, sooner or later, this shell will be discovered living in that region, and will probably be found to rate a subspecific name. Our material from the Newport Bay localities consists almost entirely of immature shells, only one valve of an adult (the one figured) having been found. In view of the inadequacy of the fossil material and of the very considerable variation in living, local examples, it is considered advisable for the present to leave the southern California shell under the name *subobsoleta*.

*Glycimeris profunda* Dall (Pl. 11, figs. 3, 3a).

This species, described in Proceedings of the U. S. National Museum, volume 1, 1879, pages 13-14, has been generally overlooked. It is not listed by Arnold, nor by Grant and Gale, and would also have been missed by the writer, had it not been called to his attention by Dr. W. P. Woodring. Dr. Woodring has examined the type lot in the National Museum and states that it is of the same species as the material from our collections to be discussed here. It is evident from Dr. Dall's description that his specimens were more or less imperfect, as some of the characters

given by him do not apply to examples in a better state of preservation. Therefore, it is considered advisable to re-describe the species.

DESCRIPTION: Shell fairly large and heavy for the genus, rounded trigonal, about as high as long; globose, the diameter usually being equal to more than two thirds of the length; posterior margin slightly produced. Hinge-plate and area wide; number of teeth varying from 15 to 30, usually 20 to 25; umbos large, usually prominent and projecting somewhat over the ligamental area. Apical angle frequently less than a right angle. External sculpture finely cancellate, often eroded and more or less obliterated in adult specimens or fossils. Adults, unless badly worn, with about 30 somewhat incised, white, radial lines, giving the shell a ribbed appearance; these lines absent on anterior and posterior areas. A considerable portion of the shell, both inside and out, showing a brown wash in most fresh specimens. Length of our largest specimen, 27.5; height, 27.7; diameter, 19.4 millimeters. Dr. Dall's type is slightly larger, measuring 30 x 32 x 20 millimeters.

The principal differences between the above description and that of Dall lie in his statements that the area is narrow, the umbos rather small and that the "exterior is marked by 25 or 30 flattened ribs, separated by deep channels one fourth as wide as the ribs." The first two of these characters are quite variable and the differences are probably individual. As to the last difference, that of external sculpture, the "ribs and deep channels" mentioned by Dall are apparent in some of our specimens, but only when the outer surface has been worn away to a certain definite extent.

It was first thought that Conrad's name *barbarensis* (U. S. Pacific R. R. Reports, VI: 71, 1857) might apply to this species, but apparently it can not be used. The description and figure are, in the absence of the type, hardly identifiable, but the diameter of the shell, as shown in the line drawing of Conrad's figure, here reproduced (Pl. 11, fig. 4), is only one half the length (about the dimensions of *subobsoleta*), therefore much too flat for *profunda*. It is unfortunate that the interior of Conrad's shell was not figured. Arnold's figures (op. cit.: pl. 18, figs. 9, 10) of "*barbarensis*" and "*septentrionalis*" both appear referable to *profunda*.

Dall's type material was secured by Henry Hemphill from fossil deposits at San Diego, and the species is listed as an extinct one. That it exists in the Recent fauna, however, is shown by six valves (Willett coll.) taken in 200 fathoms off Santa Catalina Island, and one living specimen and an additional valve (Burch coll.) secured in 25 fathoms off Redondo, Los Angeles County.

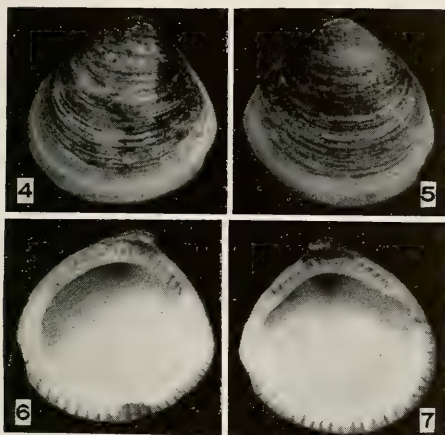
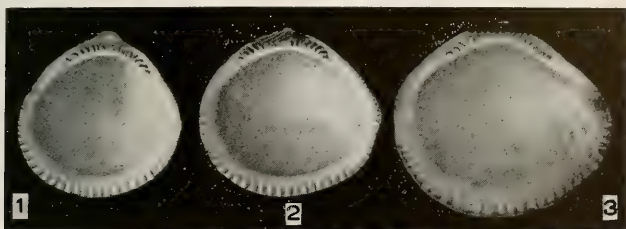


PLATE 12

1. *Glycimeris subobsoleta* Cpr., Newport, Calif. (Pleist.); 2. Same, San Pedro, Calif.; 3. Same, Forrester Id., Alaska; all nat. size; 4-7. *G. keenae* Willett, type, X2.

It is common in some Lower Pleistocene deposits, particularly so at Hill Top Quarry, San Pedro.

*G. profunda*, when adult, is usually easily distinguished from related forms by its wide hinge-plate, and heavy, globose shell, though many of the young and occasional adults exhibit characters approaching *subobsoleta*.

*Glycimeris corteziana* Dall (Pl. 11, figs. 2, 2a).

Similar to *G. subobsoleta* in shape and sculpture, but smaller and lighter in color (white, sometimes tinged with brown on interior margin), with wider hinge-plate with central teeth set far back from its margin, and *extremely narrow ligamental area*. Our largest specimen measures 20 x 18.5 millimeters, somewhat smaller than Dr. Dall's type.



Evidently a southern shell, from moderately deep water. Eight specimens in the Willett collection are from 50 fathoms off Santa Catalina Island, and in the Burch collection are two specimens from 40 fathoms off San Clemente, and 25 from 50 fathoms off South Coronado Island. As previously stated, the record for this species from Forrester Island, Alaska, resulted from misidentification. Other northern records should be carefully checked.

*Glycimeris miqueliana* Dall (Pl. 11, figs. 5, 5a).

As shown by the photo of the type, this shell is much like *subobsoleta* in general appearance. Although, according to the description, it differs from the latter by its smooth outer surface, the photo (twice enlarged) shows faint indications of radial sculpture. From the measurements given (23 x 22 x 14 mm.), *miqueliana* is a much flatter shell than *profunda*. Being entirely unfamiliar with the species, the writer offers no opinion as to its distinctness.

The shell formerly reported from Forrester Island, Alaska, as *miqueliana* was wrongly identified. It is apparently an undescribed species, which may be known as:

*Glycimeris keenae*, sp. nov. (Pl. 12, figs. 4-7).

DESCRIPTION: Shell small, rounded-trigonal, as high as long; white, unmarked with brown, with remnants of what appears to have been a blackish epidermis, which is entirely absent toward the ventral margin. Sculpture wholly concentric, of irregularly spaced growth ridges, between and on top of which are much finer incised lines which become less evident or imperceptible toward the ventral margin, in which region the growth ridges are rougher and more prominent. Hinge-plate rather narrow, angulated; teeth 20 to 25; ligamental area moderately narrow. Length, 13.5; alt., 13.5; diam., 8 mm.

TYPE: No. 1065 Los Angeles Museum. Type locality, Forrester Island, Alaska. Collected, with seven additional specimens, by G. Willett. Paratypes in U. S. National Museum, California Academy of Sciences, and Willett collection.

The combination of white color, angular hinge-plate, and concentric sculpture is sufficient to distinguish this species from all others of the genus known from the region.

The writer takes pleasure in naming this shell for Dr. Myra Keen, of Stanford University, whose work on the *Pelecypoda* has been of much assistance to students of west coast conchology.

Los Angeles Museum, Los Angeles, California.

## ADDITIONAL NOTES ON THE PERSISTENCE OF *Trypanosoma cruzi* IN DEAD INSECT VECTORS

SHERWIN F. WOOD

Department of Life Sciences, Los Angeles City College,  
Los Angeles, California

### INTRODUCTION

For many years the causative agent of Chagas' disease has been found commonly in many individuals of known insect vectors, less abundantly in mammalian reservoirs and least commonly in man. This contribution brings together apparently unrelated data which demonstrates one explanation of the abundance of naturally infected insect vectors and the greater prevalence in mammals other than man of *Trypanosoma cruzi*. The ability of this parasite to persist in a viable state in dead or immobilized insect vectors is an important factor in maintaining a large rodent reservoir population since these mammals feed on insects and acquire the infection in that way.

As previously reported by the writer (Wood, 1942b), the persistence of developmental stages of *Trypanosoma cruzi* Chagas was noted in the feces and body fluids of bugs many days after death. Additional data are presented here on the persistence of *Trypanosoma cruzi* in its crithidial and trypanoform stages in naturally-dying and cyanide-treated cone-nosed bugs (*Triatoma* spp.).

### MATERIALS and METHODS

All *Triatoma* (Hemiptera, Reduviidae) were kept in one-eighth, one-fourth, or one-half pint culture jars with perforated metal lids or 50 cc flat, wide-mouthed specimen jars on a black-topped table away from exposure to sunlight. The laboratory is in a newly constructed, reinforced concrete building. The daily laboratory temperatures on the table near the culture jars recorded in degrees Fahrenheit during the examination period from July 21 through December 18, 1942 were as follows: July 23—81, August 13—81, August 29—77, September 12—77, September 20—76, October 1—77, October 22—86, November 19—75, and

December 12—73. Most of the naturally-dying bugs were examined during July and August, 1942. Most of the cyanide-treated bugs were examined during September, October, November, and December. No regular schedule for examination of insects was possible.

All cultures harbored some stages of a mite, *Ereynetes concolor* Haldman<sup>1</sup>, parasitizing the insects. This mite has been found most frequently on *Triatoma rubida* from wood rat nests at the Alvarado Mine in Arizona. Crushed mites examined from infected bugs have been negative for trypanosomes.

As soon as the naturally-dying bugs were found immobile, i. e., unable to walk or move about on their legs in their culture jars, they were removed and placed upon their backs in 50 cc wide-mouthed specimen jars. All of the bugs in this group were actually dead when isolated except the Sanderson large nymph of *Triatoma protracta* examined on the eighth day. These bugs were left on the black-topped laboratory table, uncovered, away from radiators and exposure to sunlight. Some of these bugs died several days before isolation so they were immobile for more than the number of days actually recorded.

The cyanide-treated bugs were left from two to forty-eight hours in fresh killing bottles using potassium cyanide. They were returned to their culture jars which had perforated lids to allow free circulation of the air. After the shorter exposures, some bugs had to be treated a second time to completely immobilize them, showing some resistance to this insect-killing agent. A second exposure did not kill all bugs as evidenced by those mentioned under observations as showing feeble leg movements.

Resistance to cyanide was noted previously in one female *Triatoma protracta* collected as a nymph near Tyrone, New Mexico. The bug was supposedly killed with cyanide on March 9, 1940 and placed in a Riker mount. On May 18, 1940 this female was noted in a changed position. Closer inspection revealed the bug alive and attempting to crawl about in the cotton under the glass. This female had laid six eggs as evidenced by the presence of three active larvae, three empty egg cases, and three unhatched eggs.

References to "days after death", in all cases indicates days after actual immobilization of the insect, i. e., the bug could not

<sup>1</sup> Identification by G. F. Augustson, Allan Hancock Foundation, University of Southern California, Los Angeles, California.

move about on its legs. In some cases the bugs continued to move legs and antennae feebly for many days after immobilization, in response to exposure to a warm breath or mechanical contact of forceps. Therefore, these insects were actually not dead and so are mentioned individually under observations to distinguish them from those that showed no movements and were assumed to be dead. In order to be certain the bugs did not move about, all were kept on their backs and inspected at other times than the time of examination for trypanosomes. In one culture of *Triatoma protracta*, three of eleven nymphs showed feeble movements of legs and antennae while on their backs in the culture jar sixteen days after immobilization.

The feces of all *Triatoma* used in this experiment had been examined previously and were known to harbor *Trypanosoma cruzi*. The bodies of most bugs were cut with scissors across the middle of the abdomen detaching approximately the posterior one-third of the insect's body. This method was used so as to avoid putting excess pressure upon the posterior part of the digestive tract, a common practice in squeezing insects to obtain fecal samples. The squeezing method might result in injury to the crithidias and trypanosomes by mechanical transfer to the liquid feces of pressure applied to the surface of the abdomen. This probably occurs in the rectum which may be temporarily closed near the anus by the pressure upon curvatures in the digestive tube or near the anal outlet which may be clogged at the orifice with dried fecal matter.

The posterior portion of the insect's body with contained intestinal tract was carefully teased apart with dissecting needles in a drop of sodium-citrate solution. The droplet was then covered with a piece of broken or whole, 18 mm round, glass cover slip adequate to produce a thin enough film for easy recognition of the parasites. No attempt was made to count the parasites unless they were few in number. The form of parasite first mentioned indicates the most abundant stage, i. e., if the crithidias are mentioned first they were most abundant or if trypanosomes, they outnumbered the crithidias.

The bodies of most bugs were dry, hard and brittle when examined and showed a decided flattening of the abdomen which curled upward along its outer edges. Many of the cyanide-treated bugs were distended at time of death with blood from recent feedings and so their abdomens were rounded, tending to wrinkle, flatten, and curl as they dried. Individual differences will be mentioned under observations, the remarks referring to



the body form of the insect at the time of examination. If a bug's abdomen is described as partly full, rounded, or partially distended, this particular insect was well fed at the time it was killed, showing a well rounded abdomen in cross section.

The following abbreviations are used for strain designations, i. e., geographic sources of parasites: P, Pasadena (Eaton Canyon), and Sd, San Diego, California; C, Congress, Arizona; T, Tyrone, New Mexico; S, Sanderson, Ba, Bandera, and M, Marathon, all from Texas; and Br, Brazil, South America. The different sized nymphs of *Triatoma* are referred to as large, ln, medium, mn, and small, sn.

### OBSERVATIONS

NATURALLY-DYING INSECTS: *Triatoma protracta*: 6th day after death, 1 mn—P very flat, many actively moving trypanosomes and crithidias among numerous non-motile forms; 7th day, 1 ln—P flat, 2 moving crithidias, many recognizable degenerating forms; 1 mn—M flat, negative; 8th day, 1 ln—S flat, soft, moved legs feebly when squeezed with forceps, numerous actively motile trypanosomes and crithidias; 2 mn—Ba dry, curled, negative; 9th day, 1 ln—P, dense masses (rosettes) of actively squirming crithidias and trypanosomes; 1 ln—S dry and brittle, several dead crithidias; 1 mn—Br in partial molt, negative; 10th day, 1 ln—M legs pliable, numerous motile trypanosomes and crithidias; 13th day, 1 sn—P dry and brittle, one intact crithidia; 1 mn—P soft body, numerous living crithidias and trypanosomes; 2 sn—Br flat, dry, brittle, negative; 17th day, 1 ln—Ba flat, negative; 18th day, 3 mn—P flat, negative; 1 mn—P flat, a few dead crithidias; 25th day, 2 ln—C rounded abdomen, wrinkled, negative; and 32nd day, 1 mn—C shriveled and hard, 1 mn—C soft and pliable, abdomen wrinkled, both negative.

One large nymph of *Triatoma protracta* which died shortly after feeding to capacity was examined on the 29th day after isolation (Congress strain). The abdomen of the insect was still about one-half full although somewhat wrinkled and shriveled. As the scissors slipped off the hard chitinous surface of the abdomen several clear fecal droplets squirted from the anus, one traveling at least two feet. One droplet which landed upon a slide was immediately covered revealing numerous trypanoform stages of *Trypanosoma cruzi* moving slowly under the coverglass but actively motile in the marginal film. The bug was returned to its open jar and reexamined on the 41st day. The first drop of brownish fluid squeezed from the anus was negative. The posterior half of the abdomen yielded three preparations all of which revealed many moving crithidias. In one of these samples, one actively motile trypanosome was seen.



The fecal sample of the large nymph of *Triatoma protracta* infected with Sanderson trypanosomes examined on the eighth day, as recorded above, was diluted to 1/20cc with sodium citrate solution and used as an inoculum for experiment 116. An adult male *Peromyscus californicus insignis*, weight 45 grams, was inoculated intraperitoneally. Fresh ear blood examined on the 13th day after inoculation was negative but on the 16th day revealed 5 typical *Trypanosoma cruzi*. Feces of four medium nymphs of *Triatoma rubida* fed on the mouse on the 16th day were positive 124 days later.

*Triatoma protracta woodi*, 1 ln—M examined on the 3rd day after death showed abundant, actively motile trypanosomes and crithidias in the teased gut sample.

*Triatoma rubida (uhleri)*: 4th day, 1 mn—C flat, soft, many motile trypanosomes and crithidias; 1 mn—S flat, soft, 9 actively moving trypanosomes and 51 motile crithidias; 6th day, 1 ln—S soft, half full, several non-motile crithidias; 8th day, 1 ln—S flat, many non-motile crithidias and trypanosomes; 1 mn—S flat, 5 non-motile crithidias, many degenerating forms; 9th day, 1 sn—C flat, negative; 1 mn—Ba flat, stiff, negative; 10th day, 3 sn—C negative; 1 sn—C, a few non-motile trypanosomes and crithidias; 13th day, 1 mn—P stiff, legs pliable, numerous actively motile trypanosomes; 1 female—S very brittle, negative; 1 mn—S abdomen curled, negative; 1 mn—S flat, brittle, numerous non-motile crithidias and trypanosomes; 1 sn—Br flat, curled, negative; 1 sn—Br flat, curled, 4 degenerating crithidias (?); 14th day, 1 sn—C brittle, 4 non-motile crithidias and 2 inactive trypanosomes; 1 mn—C brittle, 4 non-motile trypanosomes; 1 mn—S flat, soft, 2 moving and a few non-motile crithidias; 15th day, 1 ln—P abdomen and legs pliable, numerous moving trypanosomes and crithidias; 20th day, 1 ln—Ba flat, curled abdomen, legs stiff, one actively motile crithidia, a few inactive trypanosomes and crithidias; and 24th day, 1 mn—T soft, pliable, numerous actively motile crithidias and trypanosomes.

The fecal sample of the medium nymph of *Triatoma rubida* infected with Pasadena trypanosomes, examined on the 13th day as noted above, was diluted to 1/10cc with sodium citrate solution. This inoculum was introduced intraperitoneally into a male *Peromyscus californicus insignis*, weight 33.5 grams, experiment 118. Ear blood examination was negative on the 16th day after inoculation. Four laboratory-raised, medium nymphs of *Triatoma rubida* fed on the mouse on the 16th day were all negative when examined 111 days later.

The fecal sample of the *Triatoma rubida* medium nymph harboring Tyrone trypanosomes, examined on the 24th day as noted above, was diluted to 1/10cc with sodium citrate solution. This solution was used in intraperitoneal inoculation of a male *Peromyscus californicus insignis*, weight 33.5 grams, experiment 117. Examination of a drop of ear blood on the 16th day after

inoculation revealed 182 trypanosomes under an 18mm circular coverglass. Two laboratory-raised, medium nymphs of *Triatoma rubida*, fed on this mouse on the 16th day, were positive when examined 127 days later.

CYANIDE-TREATED INSECTS: *Triatoma protracta*: 5th day, 1 mn—C flat, curled, a few motile trypanosomes and crithidias outnumbering non-motile forms; 1 ln—C flat, curled abdomen, numerous actively motile trypanosomes and crithidias; 7th day, 1 sn—C flat, curled, negative; 1 sn—C abdomen slightly distended, many actively motile trypanosomes and crithidias; 8th day, 1 sn—C soft, abdomen partly full, numerous actively motile trypanosomes and crithidias; 16th day, 1 mn—P rounded, shriveled abdomen about one-half full, 2 moving trypanosomes and 2 feebly moving crithidias with a few non-motile forms; 1 ln—M flat, legs not stiff, numerous actively motile trypanosomes and crithidias; 20th day, 1 female—C dry, hard, stiff, negative; 1 ln—C partly full, soft abdomen, 3 non-motile crithidias; 1 ln—C body brittle, flat, 7 non-motile crithidias; 1 ln—P and 1 mn—P flat, curled, negative; 1 ln—P many non-motile trypanosomes and crithidias; 25th day, 1 mn—P flat, brittle, negative; 1 mn—Ba stiff, negative; 1 ln—Ba flat, legs stiff, 1 non-motile crithidia and many degenerative remnants; 1 ln—Ba showing feeble movements of legs and antennae, many actively motile crithidias and trypanosomes; 28th day, 1 mn—M shriveled, soft, pliable, 4 slowly moving trypanosomes; 38th day, 1 ln—P flat, brittle, 6 non-motile crithidias and 1 trypanosome; 1 ln—M soft, pliable, about one-third full, numerous actively motile trypanosomes and crithidias; 1 ln—M soft, pliable, partly full, many actively moving crithidias and trypanosomes; 46th day, 1 mn—P dry, curled, negative; 1 mn—P soft, showing feeble leg movements, numerous actively motile trypanosomes and crithidias; 1 ln—Ba dry, brittle, negative; 1 ln—Ba dry, brittle, 1 slowly moving crithidia, several degenerating crithidias; 49th day, 1 ln—M unable to walk but showing feeble leg movements, many actively motile trypanosomes and a few crithidias; 1 ln—Ba stiff, brittle, negative; 1 mn—Ba curled abdomen, many non-motile crithidias and trypanosomes; 54th day, all bugs flat, dry, brittle, 2 ln—C and 1 mn—C negative; 1 mn—C, a few non-motile crithidias; 1 mn—C, 6 crithidias and 5 trypanosomes, all non-motile with many degenerating forms; 57th day, 1 mn—P very feeble leg movements, numerous actively motile crithidias and trypanosomes; 67th day, 1 ln—P dry, stiff, showed feeble movements of legs and antennae 21 days ago, apparently dead now, 1 slowly moving crithidia, 2 non-motile crithidias; 70th day, 1 ln—M flat, soft, showing feeble leg and antennae movements, many actively motile trypanosomes and crithidias; 77th day, both bugs showing feeble leg movements, 1 ln—M, 2 crithidias and 1 trypanosome actively motile; 1 ln—M, several actively moving crithidias and trypanosomes; 94th day, 2 ln—C abdomen about one-half full but badly wrinkled, both negative; 98th day, 1 ln—Ba dry, hard, feeble leg movements noted up to 28 days ago, apparently dead now, many slow moving trypanosomes and crithidias; 1 mn—P showing feeble leg movements, many actively motile trypanosomes and crithidias; 124th day, 2 ln—P dry, brittle, feeble leg movements noted up to 29 days ago, both negative; and 127th day, 1 ln—M showing feeble leg movements, many actively motile crithidias and a few trypanosomes; 2 ln—M soft, pliable, both showed feeble leg movements up to 29 days ago but now apparently dead, one showed many actively motile trypanosomes and a few crithidias, the other many actively motile crithidias and trypanosomes.

*Triatoma rubida (uhleri)*: 1st day, 1 sn—Br flat, many slowly moving crithidias and trypanosomes; 1 mn—S flat, a few slowly moving crithidias and trypanosomes; 10th day, 2 mn—S flat, pliable, both showed many non-motile crithidias and trypanosomes; 1 ln—S flat,

moist, numerous actively motile trypanosomes and crithidias among many non-motile forms; 16th day, 1 sn—Br flat, brittle, many non-motile crithidias and trypanosomes; 1 ln—P soft, pliable, many actively moving trypanosomes and crithidias among numerous immobile forms; 25th day, 1 male—P brittle, 17 crithidias and 3 trypanosomes, all non-motile among many other degenerating forms; 1 mn—P soft, pliable, numerous actively motile crithidias and trypanosomes showing some rosettes; 28th day, 1 mn—S flat, stiff, hard, negative; 1 mn—S flat, stiff, hard, 16 crithidias and 2 trypanosomes, all non-motile; 1 mn—S flat, soft, pliable, 3 non-motile crithidias; 1 mn—S flat, showing feeble leg movements, many actively motile crithidias and trypanosomes; 33rd day, 1 ln—S flat, limbs pliable, many actively moving crithidias and trypanosomes with numerous non-motile forms; 1 ln—S flat, limbs pliable, numerous actively motile crithidias and trypanosomes; 1 ln—M flat, curled, legs pliable, numerous actively motile crithidias and trypanosomes; 1 ln—P flat, brittle, negative; 1 male—P brittle, 2 non-motile crithidias; 34th day, 1 mn—C showed feeble leg movements, numerous actively motile crithidias and trypanosomes; 1 mn—C brittle, legs stiff, 2 non-motile crithidias; 1 mn—C brittle, legs stiff, 14 crithidias and 2 trypanosomes, all non-motile; 38th day, 1 ln—S showing feeble leg movements, numerous actively motile crithidias and trypanosomes; 1 mn—S flat, 16 trypanosomes and 8 crithidias, all actively motile; 1 mn—S flat, 22 crithidias and 10 trypanosomes, all slowly moving, and numerous non-motile forms; 1 sn—C and 1 mn—C both flat, brittle, negative; 1 ln—P flat, brittle, negative; 57th day, 1 ln—S showing feeble leg movements, numerous actively motile crithidias and trypanosomes; 67th day, 2 mn—S brittle, negative; 2 mn—P brittle, negative; 70th day, 1 mn—P flat, brittle, showed feeble movements of legs and antennae up to 21 days ago, negative; 93rd day, 1 mn—P flat, brittle, showed feeble movements of legs 60 days ago, apparently dead now, 3 non-motile trypanosomes and a number of degenerating forms; 1 ln—P flat, showing feeble leg movements, many actively motile trypanosomes and a few crithidias; 94th day, 6 mn—C brittle, negative; 1 mn—C brittle, 5 non-motile crithidias; and 122nd day, 1 ln—M about one-third full, showing feeble movements of legs and antennae, many actively motile trypanosomes and some crithidias; 1 mn—P showing feeble leg movements, 3 trypanosomes and 4 crithidias, all actively motile; 1 ln—P stiff, showing feeble movements up to 29 days ago, now apparently dead, many crithidias and a few trypanosomes, all moving slowly.

One large nymph of *Triatoma rubida* harboring Sanderson trypanosomes was supposedly dead August 13, 1942 when returned to its culture jar after at least 2 hours exposure in a cyanide jar. The bug was found alive in the culture jar on October 1, 1942. A squeezed fecal sample of this bug examined December 18, 1942 (127th day) showed many actively motile crithidias and trypanosomes. The cyanide treatment apparently had no ill effects upon the persistence of trypanosomes in this bug.

*Triatoma longipes*: 16th day, 1 mn—Br flat, still capable of erratic feeble locomotion, showed many trypanosomes and crithidias, all actively motile.

The bodies of adult bugs seem to dry out faster than the bodies of nymphs. This is probably correlated with the relative amounts of blood ingested per feeding since the larger nymphs appear to have a much greater capacity than adults if one can

judge by the expansibility of the bug's body. In the heat killed experiment reported previously (Wood, 1942b, p. 614) there were 69 adults (65 *Triatoma protracta* and 4 *T. rubida*). Examination of these bugs revealed 5 male *protracta* (T), 1 female *protracta* (C) and 1 female *rubida* (C), all positive at the time of death; 1st day after death, 1 male, 5 female *protracta* (T), 1 female *protracta* (Ba), 1 female *protracta* (C) and 1 male *rubida* (C), all positive; 2nd day, 3 female *protracta* (T) and 1 female *protracta* (Sd), all positive; 3rd day, 3 male, 2 female *protracta* (T) and 1 male, 1 female *protracta* (C), all positive; 4th day, 2 male, 3 female *protracta* (T) and 1 male *protracta* (C), all positive; 5th day, 2 male, 1 female *protracta* (T) and 1 male, 2 female *protracta* (C), all positive, 1 female *protracta* (T) negative; 6th day, 2 male, 1 female *protracta* (T) and 1 male *protracta* (C) positive, 1 female *protracta* (T) negative; 7th day, 2 male, 2 female *protracta* (T), 1 male *protracta* (C) and 1 male *rubida* (C), all positive; 8th day, 2 male, 1 female *protracta* (T) and 1 female *rubida* (C), positive, 1 female *protracta* (T) negative; 9th day, 2 male, 1 female *protracta* (T) positive, 1 female *protracta* (T) negative; 10th day, 3 female *protracta* (T) and 1 male *protracta* (Ba) positive; 11th day, 2 female *protracta* (T) negative; 12th day, 1 female *protracta* (T) positive; and 13th and 14th days, 1 female *protracta* (T) each, both negative.

The experimental results reported here indicate 1 female *rubida* negative on the 13th day and 1 female *protracta* negative on the 20th day whereas 1 male *rubida* was positive on the 25th day and another on the 33rd day.

The bodies of dead adults and nymphs have been collected in the field. The abdomen of one male *Triatoma gerstaeckeri* was found in a wood rat nest 23 miles south of Catarina, Webb Co., Texas, August 4, 1939 and the entire body of a female of the same species was found in a cobweb behind the bed at a ranch near Bandera, Medina Co., Texas, August 6, 1939. The dry, brittle body of one female *T. rubida* was collected May 31, 1940 in a web of a black widow spider in a wood rat nest near Congress, Yavapai Co., Arizona. One female *T. protracta* covered with cobwebs collected in a house was received on September 17, 1941 from Mr. Fred E. Reynolds, Trimmer Springs, Fresno Co., California and another was collected November 2, 1941 from a wood rat nest in Griffith Park, Los Angeles, L. A. Co., California. Other dead *protracta* have been found in wood rat nests from Murray Canyon, San Diego Co., California.

Both F. D. Wood (1934a) and the writer (1942b) have shown that rodents readily eat cone-nosed bugs. In experimental



work with the San Diego strain of *Trypanosoma cruzi*, F. D. Wood reported an albino rat, *Rattus norvegicus*, voluntarily eating 6 infected *Triatoma protracta* and a San Diego wood rat, *Neotoma fuscipes macrotis*, eating 2 infected bugs of the same species. The writer (1942b and 1943) has reported previously that an albino mouse, *Mus musculus*, chewed an infected *Triatoma rubida* nymph and that a young albino rat, *Rattus norvegicus*, ate 9 adult and 4 large nymphs of *Triatoma protracta*. A male albino mouse, *Mus musculus* (experiment 44), escaped from its cylinder and ate 10 small nymphs of *Triatoma protracta* on August 31, 1939. An adult female Thomas wood rat, *Neotoma lepida lepida*, kept in a large cage with exercise wheel and plenty of food and water ate 35 cyanide-killed *Triatoma protracta* (26 mm, 9 sn) from one-half of a 6 inch petrie dish on July 8, 1942. On July 9th, 13 small nymphs and 1 female *Triatoma rubida* killed with cyanide were put in the cage. Five small nymphs were eaten by late afternoon and all were gone by noon of July 10, 1942. The head and about one-third of the thorax of the adult female were eaten on July 10th and no traces could be found of the insect on July 12th. In another cage, one young male and one young female Thomas wood rat, *Neotoma lepida lepida*, ate 5 cyanide-killed medium nymphs of *Triatoma longipes* on July 8th and 16 cyanide-killed small nymphs of *Triatoma rubida* on July 9, 1942. The wood rats showed no signs of ill effects from eating cyanide-killed insects.

F. D. Wood (1934a) reported infection by mouth of the following animals with the San Diego strain of *Trypanosoma cruzi*: a 21 day old albino rat splenectomized 6 days before it ate 6 infected *Triatoma protracta*; three 10 day old albino mice fed macerated, citrated intestine and rectum of *T. protracta*; one immature rhesus monkey, *Macacus rhesus*, fed salinized, macerated intestine and rectum of *T. protracta*; one 30 day old San Diego wood rat, *Neotoma fuscipes macrotis*, which ate 2 *T. protracta*; 1 adult Gilbert white-footed mouse, *Peromyscus truei gilberti*, fed citrated intestinal and rectal contents of *T. protracta*; one 9 day old southern parasitic mouse, *Peromyscus californicus insignis*, which had salinized feces of *T. protracta* placed in its mouth; and 1 immature parasitic mouse, *Peromyscus c. californicus*, fed citrated, intestinal and rectal contents of a *T. protracta*. One 7 day old southern parasitic mouse was also infected orally with a Brazilian strain by feeding macerated, citrated intestinal and rectal contents of a *T. protracta*.

As was noted above, many of the bugs were able to move legs and antennae for many days after exposure to cyanide al-



though they could not stand, walk, or turn over from their backs. This condition has also been observed in the following naturally-dying bugs: two large nymphs of *T. protracta* reported previously (1942b, pp. 616-617), and one *T. protracta* examined on the 8th day as reported here.

## DISCUSSION

As reported above, dead and living bugs have been found in wood rat nests and human habitations. Dead bugs have been collected in nests and houses from areas where *Trypanosoma cruzi* occurs in insect vectors. As shown here, these insects may harbor infective stages of *T. cruzi* many days after death. Furthermore, the bugs may move their appendages for some time after immobilization without being able to change their location so that there would be a greater possibility of rodents noticing them. Rodents chancing upon dying or dead bugs in nests could pick up this infection as shown by experiment 101 (Wood, 1942b, p. 616) and experiments mentioned above of F. D. Wood which were summarized briefly in 1934 (1934b, p. 502). Therefore, this occurrence of bugs in wood rat nests and houses after death may be an important source of infection for hungry rodents as well as dogs and cats since verbal communications of miners from the Alvarado Mine in Arizona report both dogs and cats eating or mouthing house-invading *Triatoma*. This would help to explain the widespread occurrence of the infection as demonstrated in native mammals from Texas (Packchanian, 1942) and in insect vectors from the southwestern United States (Wood, 1942a). The actual temperature and humidity conditions encountered in wood rat nests in the Southwest by the writer are such as to offer the possibility of dead bugs persisting in a semi-moist condition for some time after death.

During the summer of 1942, in the process of examining these *Triatoma* to check their infectiveness, careful attention was given to the amount of pressure applied to the tip of the bug's abdomen. The writer noted that although the fecal matter squeezed from the bugs showed many trypanosomes, often the parasites were non-motile. A possible explanation of this could be the immobilization of the parasites through pressure changes initiated by the squeezing method used in obtaining the fecal matter. Sometimes there seems to be a slight congestion of the anal aperture that is forced open by pressure causing the feces to spurt some distance from the insect. This pressure, momentarily applied to the surface, is transmitted mechanically to the small quantity of

liquid feces in the rectal and anal regions of the alimentary canal, which is squeezed between the upper and lower thickened abdominal walls, by the firm movement of the forceps over the end of the abdomen of the bug. Could not this pressure immobilize and kill the parasites in the digestive tube segment affected? This condition probably could account for some of the irregularities noted in intensity of infection produced in animals inoculated with feces obtained in this way. This pressure hazard was avoided here by cutting the bug's abdomen with scissors and then teasing the digestive tube apart, thus freeing the contained parasites.

As is experimentally shown here, comparing naturally-dying and cyanide-treated insects, one would expect to find parasites for a longer time in the treated bugs. One reason for this is the greater volume of body fluids in the killed insect's body at the time of death since naturally-dying bugs tend to become very flat and apparently dehydrated when starved to death. However, some exceptions to this are noted in the naturally-dying bugs with body fluid invasions and occasional forms which have died from apparent natural causes soon after taking a meal of blood. In the naturally-dying bugs the longest persistence of metacyclic stages of *Trypanosoma cruzi* noted was 41 days (*T. protracta*, ln) as compared with 127 days (*T. protracta*, ln) for the cyanide-treated group of bugs.

Observations on bugs with body cavity invasions indicate that the trypanosomes cause the death of the insect (Wood, 1942b, p. 618). This might lead to a higher death rate in cultures of infected bugs as compared with uninfected bugs. No proof of this can be offered here since the bugs from the writer's cultures have all been infected experimentally at one time or another.

How long can *Trypanosoma cruzi* survive in the dead insect host as a potentially infective agent of rodents and man? This question is partially answered here by the observations reported above on naturally-dying insects indicating infection of rodents with Sanderson trypanosomes from *Triatoma protracta* after 8 days and with Tyrone trypanosomes from *Triatoma rubida* after 24 days.

### SUMMARY

Eighty-seven cases of the persistence of *Trypanosoma cruzi* in apparently dead or immobilized cone-nosed bugs are reported here.

The longest records for detection after death of living *T. cruzi* in naturally-dying bugs were: *Triatoma protracta*, 1 mn (P)—13th day, 1 ln (C)—29th and 41st days; *T. p. woodi*, 1 ln (M)—3rd day; and *T. rubida*, 1 mn(T)—24th day.

The longest records for persistence of living *T. cruzi* in cyanide-treated bugs after death or immobilization were: *Triatoma protracta* without feeble leg movements, 1 sn(C)—8th day, 1 mn(M)—28th day, 1 ln(M)—38th day; *T. protracta* with feeble leg movements, 1 mn(P)—98th day and 1 ln(M)—127th day; *T. rubida* without feeble leg movements, 1 sn(Br)—1st day, 1 mn(S)—38th day, 1 ln(M)—33rd day; *T. rubida* with feeble leg movements, 1 mn(P)—122nd day, 1 ln(P)—122nd day; and *T. longipes* with feeble leg movements, 1 mn(Br)—16th day.

The longest records for detection of recognizable non-motile crithidias or trypanosomes or both of *T. cruzi* were: (1) naturally-dying bugs, *T. protracta*, 1 sn(P)—13th day; *T. rubida*, 1 sn(C)—14th day and 1 ln(Ba)—20th day, and (2) cyanide-treated bugs, *T. rubida*, 1 sn(Br)—16th day, 1 mn(C)—94th day and 1 male (P)—33rd day.

The persistence of viable trypanosomes in dead cone-nosed bugs, the feeding of wood rats on these dead bugs, and the infection of rats with trypanosomes from feeding on dead infected bugs indicates a method of maintaining numerous animal hosts of Chagas' disease in nature.

## REFERENCES

- Packchianian, A. 1942 Reservoir Hosts of Chagas' Disease in the State of Texas. Natural infection of nine-banded armadillo (*Dasypus novemcinctus texanus*), house mice (*Mus musculus*), opossum (*Didelphis virginiana*), and wood rats (*Neotoma micropus micropus*) with *Trypanosoma cruzi* in the State of Texas. Am. Jour. Trop. Med., 22, 623-631.
- Wood, F. D. 1934a Natural and experimental infection of Reduviid bugs and mammals in California with American human trypanosomiasis. (Doctorate Thesis, University of California Library, Berkeley), 132 pp.

- 1934b Natural and experimental infection of *Triatoma protracta* Uhler and mammals in California with American human trypanosomiasis. Am. Jour. Trop. Med., 14, 497-517.
- Wood, S. F. 1942a Observations on vectors of Chagas' disease in the United States. I. California. Bull. So. Calif. Acad. Sci., 41, 61-69.
- 1942b The persistence of *Trypanosoma cruzi* in dead cone-nosed bugs (*Hemiptera, Reduviidae*). Am. Jour. Trop. Med., 22, 613-621.
- 1943 Observations on vectors of Chagas' disease in the United States. II. Arizona. Am. Jour. Trop. Med., 23, 315-320.



THE LIFE HISTORY OF *POLITES SABULETI* BDV.

By V. G. DETHIER

Like many other members of the genus the larvae of *Polites sabuleti* Bdv. exhibit a characteristic color design on the head by which they may be readily recognized. No complete records of the immature stages of this skipper have thus far been published. The following notes, based on studies of a series of eleven larvae reared from adults taken in Solano County, California, are presented to complete the life history and to aid in the identification of this species.

EGG: Diameter, 0.75 mm.; height, 0.5 mm. Pale green to blue green becoming cream colored as development proceeds. Surface with faint microscopic reticulation.

FIRST INSTAR: Head height, 0.47-0.50 mm.; head width, 0.47-0.50 mm. Shiny piceous to black. Sutures darker, mouth-parts lighter. Surface of head with shallow microscopic vermiculations. Few colorless tapering hairs. Length of body, 2.0-4.1 mm. General color at time of emergence from egg, cream. Clear light green after feeding. Shield concolorous with head. Legs and spiracles concolorous with body. Scattered colorless, spatulate hairs on dorsum. Hairs on remainder of body tapering. Pair of long forwardly recurved hairs on anal plate. Also a pair of shorter ventrally recurved hairs in same region.

SECOND INSTAR: Head height, 0.75 mm.; head width, 0.70 mm. Piceous to black, more or less shiny. Surface rougher than before. Difference in color between sutures and rest of head not so pronounced. Colorless tapering hairs shorter and more numerous. Length of body, 4.1-6.5 mm. General color dull light gray green. Dorsum powder green with clear green splotches. Mid-dorsal line clear green. Irregular clear green supra-stigmatal and sub-stigmatal lines. Ventum clear yellowish to colorless. Anal segment yellowish. Shield concolorous with head. Spiracles green with black rims. Claws of legs fuscous. Short stiff, black, spatulate hairs arising from black tubercles scattered over dorsum. Hairs on shield, anal plate, and ventum tapering.

THIRD INSTAR: Head height, 1.0-1.1 mm.; head width, 0.9-1.0 mm. Dark piceous, duller than before. Surface with very



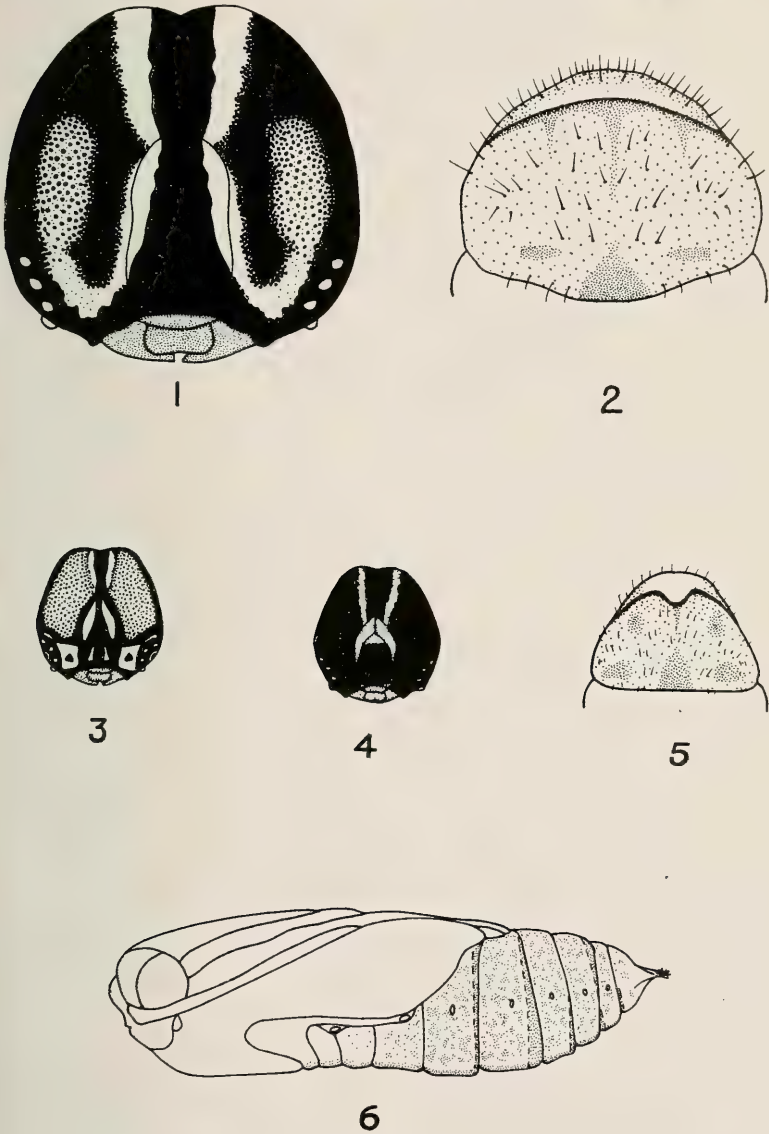


PLATE 13

- Fig. 1. Front aspect of the head of the larva (last instar) of *Polites sabuleti* Bdv.  
Fig. 2. Dorsal aspect of the anal plate of same.  
Fig. 3. Front aspect of the head of the larva (third instar) of *Polites sabuleti* Bdv.  
Fig. 4. Another form of the same.  
Fig. 5. Dorsal aspect of the anal plate of fourth instar.  
Fig. 6. Lateral aspect of the chrysalis of *Polites sabuleti* Bdv.

pronounced broken reticulation. Hairs shorter, more numerous. Very dull indistinct head pattern appears in most individuals in this instar. Composed of a light fuscous, narrow, irregular band on each side of the coronal suture, continuous with a wider band in each adfrontal area. The latter band frequently extends through the apex of the clypeus. The color pattern is best seen on cast head capsules (Fig. 4). In other individuals the pattern takes the form shown in figure 3 in which case it is more prominent. Length of body, 6.5-10 mm. Body generally brownish. Dorsum brownish green with dull green mottling. Mid-dorsal line clear brown. Faint supra-stigmatal and sub-stigmatal lines resulting from absence of mottling in these areas. Shield concolorous with head. Spiracles concolorous with body. Legs fuscous. Posterior edge of anal plate light colored. Anal pattern sometimes appears in this instar. Hairs on dorsum spatulate, apical edge irregular. Arise from dark brown to black tubercles. Hairs on head, venter, and anal plate tapering.

FOURTH INSTAR: Head height, 1.90 mm.; head width, 1.75 mm. Very nearly black in color. Surface rugose. Covered with fine, short, colorless hairs. Head pattern very distinct and very light fuscous in color. Composed of a line on each side of the coronal suture, extending from the vertex to the adfrontal area where there is an interruption or merely a constriction as it joins another line extending through the adfrontal area. Each adfrontal line continues in a curve passing dorsad of the ring of ocelli. From this point it extends further dorsad as a suffused area pocked with piceous dots (Fig. 1). Length of body, 10-16 mm. General color brownish with soiled white mottling. Mid-dorsal line dark brown. Indistinct interrupted supra-stigmatal line brownish as a result of absence of mottling. Sub-stigmatal line very faint, greenish. Faint whitish mid-ventral line. Venter and intersegmental areas greenish. Legs and spiracles fuscous. Anal pattern very distinct. Ground color whitish, more or less shiny. Design black (Fig. 5). Body covered with short, black, slightly spatulate hairs.

FIFTH INSTAR: Head height, 2.8 mm.; head width, 2.5 mm. Very little change from previous instar. Design whiter and more pronounced. Length of body 16-23 mm. Body dull green heavily mottled with chocolate, producing a general appearance of dull chocolate. Mid-dorsal line very dark chocolate. Supra-stigmatal and sub-stigmatal lines formed by coalescence of chocolate mottling, faint and irregular. Subventral fold dull green. Venter generally dull greenish. No mottling. No visible mid-ventral line. Spiracles and legs fuscous. Design on anal plate similar to that in previous instar. Amount of black slightly reduced (Fig. 2). Body hairs short, sharp, and pointed. Black.

**CHRYSLIS:** Length, 15 mm. Initially the entire pupa is light clear green except in the abdominal region where the general color is pale rusty brown. This brown appearance is due to rusty colored mottling. Dark brown to fuscous mid-dorsal line. Intersegmental areas brown. As development proceeds, the eye regions become pink, the tip of the tongue case brown, the wing pads and abdomen yellowish. Later the dorsum and mouthparts become dark brown. Evenly scattered tawny tapering hairs on dorsum. Those on posterior edge of abdominal segments directed caudad.

Eggs of this skipper are laid singly on or near numerous species of grass. Although many species of grasses and sedges may serve as food, the more succulent parts of tender forms are preferred. The period of incubation varies. Eggs laid July 29 hatched ten days later. Some laid August 26 hatched after seven days. Individuals emerging from the former completed the first instar in twelve days while those from August eggs required but five days. The second instar required from five to six days; the third, an average of six days; the fourth, nine days; the fifth, twenty days. Individuals which pupated October 1 emerged October 16.

*Polites sabuleti* appears to be double brooded in Solano County. Adults were first taken toward the end of May. Oviposition was common from the first of July on. A second brood appeared on the wing throughout the latter part of September and during October at which time oviposition was observed. It is not known, however, in what stage this insect passes the winter.

---

Editor's note: The egg of *Polites sabuleti comstocki* Gund., a desert race of the Sandhill Skipper, was described and illustrated in the "Bulletin", Vol. 28, Part 2, p. 26, 1929.

There is probably no difference between the egg of this race and that of typical *sabuleti*.

Captain Dethier's complete description of the life cycle of this species, together with his excellent illustrations, rounds out the biological picture of this interesting California skipper.

J.A.C.

## MATURE LARVA OF GRAPTOLITHA LONGIOR SM.

By JOHN ADAMS COMSTOCK AND CHRISTOPHER HENNE

During a collecting trip in Smokey Valley, Tulare County, Calif., on June 19th of this year, at an elevation of 6200 ft., the junior author secured two larvae, feeding on *Juniperus utahensis* Engelm., one of which was reared to maturity. The resulting imago turned out to be *Graptolitha longior* Sm., the larva of which has not heretofore been described.

Mature larva: Length, 32 mm. Body, cylindrical, robust, of the usual noctuid type.

Head green, of a slightly yellower tinge than ground color of body. Ocelli, white at the base, tipped with black. Antennae, green. Mouth parts edged with black.

A prominent scutellum occurs on the first segment. This is glistening green, of the same shade as head. On it are a few quadrate greenish-white spots grouped along the anterior and posterior margins.

Ground color of body, deep green. Mid-dorsally there is a row of kite-shaped greenish white spots, each one centering on the segmental juncture. Dorso-laterally there is a wide irregular band of the same color which bears the semblance of a branch with alternating buds. Two of these buds are present on each segment, the first and most anterior extending downward toward the spiracle (but not touching it); the second extending upward. Stigmatically there is a wavy line of somewhat the same character as the last described band. Below this, and over the entire abdominal surface the whitish green shade predominates.

Legs, concolorous with head, the tips of terminal segments black. Prolegs, greenish white. Anal proleg, mottled green and greenish white. Crochets, black. Spiracles, velvet black, narrowly rimmed with greenish white.

A few short colorless hairs occur over the body, each one arising from a greenish white round spot.

The larva is colored and marked in a manner to give it maximum protection when feeding on the juniper.

The single example which carried through pupated under moss, not in the soil. A small amount of silk was used to unite the surrounding pieces of moss into a loose case, too fragile to be called a cocoon. It was deemed inadvisable to disturb the chrysalis, and hence the pupa remains to be described.

The imago emerged October 23, 1943.

## ADDITIONAL NOTES ON ERINNYIS ELLO L. (Lepidoptera; Sphingidae)

By JOHN ADAMS COMSTOCK

In the "Bulletin" for Sept.-Dec., 1938 (Vol. 37, pp. 105-110) the author, writing in association with Commander Dammers, described the life history of *Erinnyis ello* L. Therein we recorded two rather distinct color forms of the larva.

Recently we have had called to our attention, through the courtesy of Frank Sala, the fact that Floridian specimens of this species show an extreme variation in larval color and pattern which goes far beyond any examples thus far noted in the literature.

A description of the mature larva of this color phase follows:

Length, 80 mm. Width of head 5. mm. Head flattened anteriorly, about the same width as first body segment. Ground color of head, coral pink, with a prominent black longitudinal band crossing the front portion of each cheek, and the sutures outlined in fine black lines. Mouth parts and antennae, lighter pink than the cheeks. Ocelli black, resting on a black crescent which at its lower point, is continued back on the side of the cheek as a wide black band.

A few delicate short straw-colored setae occur on the head, particularly in the lower portion near the mouth parts.

First segment, coral pink, with a narrow black mid-dorsal stripe and a wide black band lateral to it. Lower down on the lateral surface of this segment is a large black area, speckled with burnt orange spots. The spiracle is large and prominent, hyaline in the center and rimmed with yellow-brown.

Between the second and third segments, mid-dorsally placed, is a black triangular spot, crossed in the center by a longitudinal fine crenulated line. Lateral to this spot the body is tinged with deep pink.

The remainder of the body is predominantly a bright slaty blue, with a sprinkling of very fine black dots and transverse short stripes, so small as to be discerned only with a lens. The segmental junctures are laved with pink.



In the stigmatal area there is a heavy mottling of black and burnt orange spots, and at each segmental juncture a pair of prominent white spots, superior to each of which is a pair of quadrate velvety black spots.

The spiracles are white, with black rims, and posterior to each one is an area in which the burnt orange spots coalesce. These features are clearly shown in our drawing (Plate 14), which depicts the 7th segment in lateral aspect, enlarged.

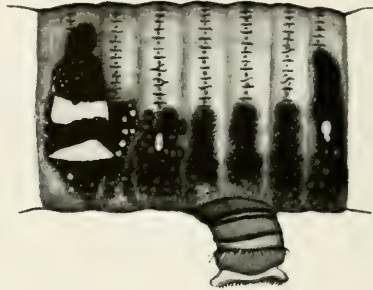


PLATE 14

Seventh segment of larva of *Erinnyis ello* L.,  
lateral aspect, enlarged X4.  
Reproduced from painting by John A. Comstock.

The abdominal surface is a mottled blue and black, heavily overlaid with round spots of a washed-out pink.

The caudal horn is reduced to a pointed knob, crowned with coral pink in its upper half, and blue in the lower half, with a black circlet separating the two contrasting colors.

The anal area is made up of a supra-anal triangular pad, and two prominent lateral pads, both of which extend downward to partly obscure the anal proleg. These are dull maroon, overlaid with round white dots.

Legs; coral pink, with black circlets marking the edges of the segments.

The prolegs are highly conspicuous in their bold coloration and striping. The two anterior pair are as follows: A proximal segment of bright yellow, edged distally with velvety black. Next to this, a bright blue element narrowly edged outwardly with black; distal to this a wide band of bright coral edged with black; below this a narrow band of pink edged with black; distal to this a band of dark purple. The terminal pad is white, and the crochets yellow-brown.



## PLATE 15

Mature larva of *Erinnyis ello* L., feeding on *Poinsettia*.  
Approx. natural size.

Photo courtesy L. A. County Museum.

The two prolegs caudal to this first described pair have much the same coloring except that the bright yellow stripe is lacking.

The mature larva from which the above description was drawn is shown on Plate 15.

In comparing this description with those previously published it becomes apparent that the larva of *Erinnyis ello* is highly variable. Possibly this range of variation may not be so noticeable in specimens taken in a given locality. We have, as yet, seen no examples of the larvae from California that are as brilliantly colored as are those from Florida.

## In Memoriam

FORDYCE GRINNELL, JR.

1882 - 1943

This summer has marked the passing of Fordyce Grinnell, Jr., founder of the Lorquin Natural History Club, and an early member of the Southern California Academy of Sciences. His death occurred in the French Hospital, San Francisco, on July 20th, from heart failure. He had entered the hospital a few days previously to be prepared for a serious operation. An autopsy revealed the fact that death was merciful, as he could not have survived the operation.

Fordyce Grinnell, Jr. was born at Pine Ridge Indian Agency, South Dakota, June 17, 1882, a son of Fordyce Grinnell, M. D., and Elizabeth Pratt Grinnell. He was educated in the public schools of Pasadena and at Stanford University. At an early age he developed a keen interest in natural history, and particularly the study of insects, together with a bent for organizing his associates into study groups.

The small group of outdoor enthusiasts which he inspired and led founded the Lorquin Natural History Club in 1913. This club was the precursor of the Lorquin Entomological Society, now a thriving association of entomologists that keeps alive the traditions and principles laid down by its founder.

Fordyce Grinnell's interests in natural history covered a broad field, but his specialty was the Lepidoptera. During his active years of devotion to entomology he published a considerable number of papers in such journals as the *Entomological News* (1901-1915); *Canadian Entomologist* (1901-1909); *Journal of Entomology and Zoology, Pomona* (1909-1914); *Psyche* (1910); *Bulletin of the Brooklyn Entomological Society* (1914); *Journal N. Y. Entom. Society* (1907); *Lorquinia* (1916-1917) and the *Bulletin Southern California Academy of Sciences* (1910-1916).

He discovered and described several California butterflies and moths, among which were:

Grinnell's Marble	<i>Anthocharis lanceolata australis</i>
Behr's Satyr	<i>Minois behrii</i>
Edward's Painted Lady	<i>Vanessa atalanta edwardsi</i>
Grinnell's Butterfly	<i>Vanessa carye intermedia</i>
Letcher's Butterfly	<i>Vanessa carye lecheri</i>
The Desert Hair-streak	<i>Strymon sylvinus desertorum</i>
Grinnell's Blue	<i>Everes comyntas herrii</i>
The Hilda Blue	<i>Plebeius saepiolus hilda</i>
Cottle's Blue	<i>Plebeius acmon cottlei</i>
The San Emigdio Blue	<i>Plebeius emigdionis</i>
The Southern Blue	<i>Glaucopsyche lygdamus australis</i>
Grinnell's Dusky-wing	<i>Erynnis persius pernigra</i>
The Artful Dusky-wing	<i>Erynnis callidus</i>
The Tecumseh Skipper	<i>Polites sabuleti tecumseh</i>

In the moths Fordyce Grinnell paid particular attention to the *Pterophoridae*, several of which were named by him.

After completing his studies at Stanford, Grinnell taught school for some years in the Hawaiian Islands, and later in the Philippines.

He lived and traveled in Australia for several years, and spent the summer of 1936 in Eagle, Alaska. From that time on he lived a retired life at Sausalito, Calif. He was married on August 10, 1937 to Mary Dorothea Walters, who survives him.

J. A. C.

# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,  
Los Angeles 7, Calif., U. S. A.

---

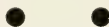
## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.



## Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1943, including volumes XXIV to XLII, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

## MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939.



# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 1, 1926 .....	2.00	4.00
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50
" 42, " 1, 2, 3, 1943 (each) .....	.25	.50

(Continued on next page)

# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ “ “ printed on one side of page (bound) .....	2.75	4.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published) ...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall .....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfami- lies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....	\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....	.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....	3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis	.50

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

(Care DR. JOHN A. COMSTOCK)

Los Angeles Museum, Exposition Park,

Los Angeles 7, Calif., U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

**Form of Legacy**

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of..... Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

**Form of Devise**

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.....), here describe the property or ground rent.....), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.



# Bulletin, Southern California Academy of Sciences

Vol. XLII, 1943

## INDEX OF SUBJECTS

A New Parasitic Fly from Bats	52	Graptolitha longior, Mature Larva of	132
A New Subspecies of <i>Orchopeas sexdentatus</i>	49	<b>Henricus</b> , A New Name for a Phaloniid Genus	38
Additional Notes on <i>Erinnyis ello</i> L.	133	<i>Heinrichia</i>	38
Additional Notes on the Persistence of <i>Trypanosoma cruzi</i> in Dead Insect Vectors	115	<i>Juniperus utahensis</i> Engelm	132
Birds of El Segundo and Playa del Rey	1, 90	<i>Leptarectia californiae</i> , Notes on the Metamorphosis of	67
Black Widow Spider	38	Life History of <i>Pseudalypia crotchii</i> Hy. Edw.	59
California Species of <i>Smerinthus</i> with Notes on the Early Stages of <i>S. cerisyi ophthalmicus</i>	42	<b>Lupinus Moranii</b> Dunkle	33
<b>Castilleja grisea</b> Dunkle	31	<i>Macrotus californicus</i>	52
<i>Compsilura concinnata</i> Meig.	44	<i>Malva parviflora</i> L.	61
Contributions from the Los Angeles Museum—Channel Islands Biological Survey	31	<i>Malvastrum exile</i> Gray	59
<i>Copieucullia basipuncta</i> , The Larva of	45	Mature Larva of <i>Graptolitha longior</i> Sm.	132
El Segundo Sand Dunes, The Fauna and Flora of	1, 90	<i>Neotoma lepida devia</i> Goldman	50
<i>Erinnyis ello</i> L., Additional Notes on	133	Northwest American Species of <i>Glycimeris</i>	107
Fauna and Flora of the El Segundo Sand Dunes	1, 90	Notes on the Metamorphosis of <i>Leptarectia californiae</i> Wlk.	67
Fordyce Grinnell, Jr., In Memoriam	136	Notes on California Spiders	34
<i>Glycimeris corteziانا</i> Dall	114	<i>Orchopeas sexdentatus neotomae</i> Augustson	49
<b>Glycimeris keenae</b> Willett	114	<i>Pachysphinx modesta</i> Harr.	39
<i>Glycimeris migueltiana</i> Dall	114	<i>Pachysphinx modesta occidentalis</i> Hy. Edw.	39
<i>Glycimeris</i> , Northwest American Species of	107	<i>Polites sabuleti</i> Bdv., Life History of	128
<i>Glycimeris profunda</i> Dall	111	<i>Polites sonora siris</i> Edw. Raised from the Syonymy	46
<i>Glycimeris septentrionalis</i> (Middendorff)	109	Preliminary Records and Discussion of Some Species of Siphonaptera from the Pacific Southwest	69
<i>Glycimeris subobsoleta</i> (Carpenter)	111	<i>Pseudalypia crotchii</i> , Life History of	59
		<i>Pseudalypia crotchii atrata</i> Hy. Edw.	59
		<i>Ribes malvaceum</i> v. <b>clementinum</b> Dunkle	32





<i>Smerinthus cerisyi astarte</i> Stkr. ....	42	The Life History of <i>Polites</i> <i>sabuleti</i> Bdv. ....	128
<i>Smerinthus cerisyi ophthalmicus</i> Bdv. ....	42	Three New Plants from San Clemente Island .....	31
<i>Smerinthus cerisyi saliceti</i> .....	42	<i>Triatoma</i> spp. ....	115- 127
<i>Stephanomeria runcinata</i> Nutt	45	<i>Trichobius adamsi</i> Augustson	52
<i>Teutana grossa</i> , On the Life History and Progressive Fac- tor in Growth of .....	34	Western Poplar Sphinx .....	39
		<i>Winthemia quadripustulata</i> Fab. ....	41

New varieties and species indicated in **bold face type**

# INDEX OF AUTHORS

Augustson, G. F. ....	49, 52, 69	Dunkle, M. B. ....	31
Branch, J. H. ....	34	Henne, Christopher .....	45, 132
Busck, August .....	38	Martin, Lloyd M. ....	46
Comstock, John A. ....	39, 42, 45, 59, 67, 132, 133	von Bloeker, Jack C. ....	1, 90
Dammers, Charles M. ....	39, 42, 67	Willett, George .....	107
Dethier, V. G. ....	128	Wood, Sherwin F. ....	115



REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# PRINTING

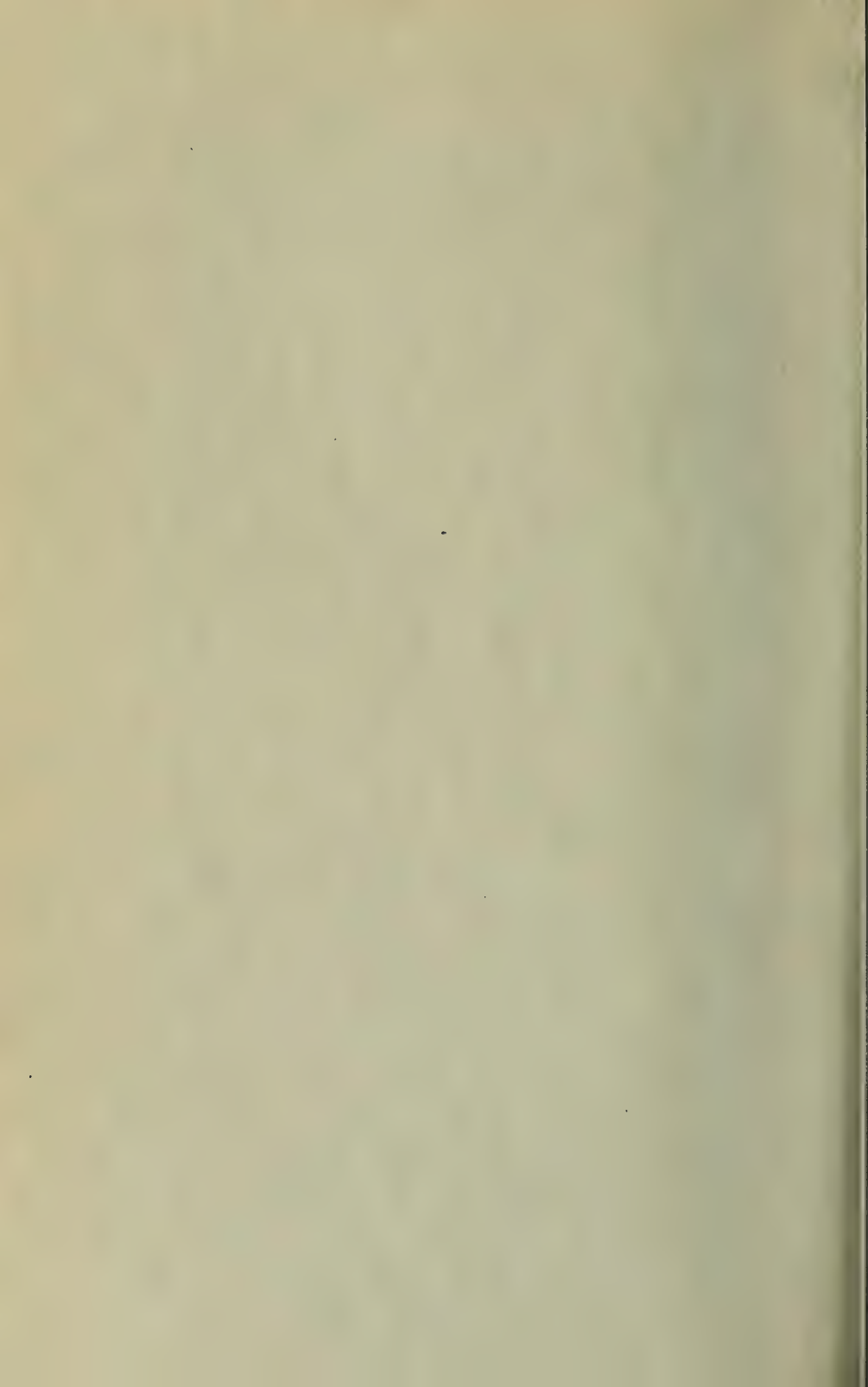
Books • Catalogs • Broadsides  
Stationery and Office Forms



## McBRIDE PRINTING CO.

PHONE: PROspect 2045  
415 EAST ELEVENTH ST.  
Los Angeles 15, Calif.

*"Since 1879"*





# BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

*Mostra tubimur ipsi.*



VOL. XLIII

JAN. - APRIL, 1944

PART I

## CONTENTS

FOSSIL ARTHROPODS OF CALIFORNIA:	Page
W. Dwight Pierce	
1. Introductory Statement	1
2. Description of Lower Miocene Fossil Carabid Beetle with a Discussion of Coleopterous Elytra	4
3. Description of a Deep Well Lower Miocene Carabid Beetle	10
4. Two Interesting Orthopteroids from Diatomaceous Deposits	12
5. A Crystallized Millipede from Volcanic Rock in a Well	13
TWO NEW WEST AMERICAN PELECYPODS:	
G. Willett	19
HYDRIOMENA STUDIES. 1. The Glaucata-crockeri Group	
J. McDunnough	23
NOTES ON THE IMMATURE STAGES OF URBANUS TESSELLATA OCCIDENTALIS SKIN:	
V. G. Dethier	30
LAND SLUGS IN CALIFORNIA:	
W. H. Lange, Jr.	33
COLLECTING AND PRESERVING LAND SLUGS:	
Wendell O. Gregg, M.D.	41
THE REPTILE ASSOCIATES OF WOOD RATS AND CONE-NOSED BUGS:	
Sherwin F. Wood	44

# Southern California Academy of Sciences



## OFFICERS and DIRECTORS

DR. W. DWIGHT PIERCE - - - - - *President*  
DR. H. J. ANDREWS - - - - - *First Vice-President*  
DR. WILLIAM L. LLOYD - - - - - *Second Vice-President*  
DR. JOHN A. COMSTOCK - - - - - *Secretary and Treasurer*

DR. H. J. ANDREWS	DR. HOWARD R. HILL
DR. A. WIER BELL	DR. WILLIAM L. LLOYD
MR. FRED E. BURLEW	MR. THEODORE PAYNE
DR. JOHN A. COMSTOCK	DR. W. DWIGHT PIERCE
MR. SAMUEL MOODY HASKINS	DR. ROBERT L. RUTHERFORD
MR. R. S. WOGLUM	



## ADVISORY BOARD

DR. CHESTER STOCK                      DR. R. H. SWIFT



## BOTANICAL SECTION

MR. THEODORE PAYNE, *Secretary*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT

## FINANCE COMMITTEE

MR. FRED E. BURLEW, *Chairman*

MR. SAMUEL MOODY HASKINS

## PROGRAM COMMITTEE

DR. ROBERT L. RUTHERFORD, *Chairman*                      DR. HOWARD R. HILL



## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK, *Chairman*

DR. CHESTER STOCK                      DR. WILLIAM L. LLOYD



## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif.

## FOSSIL ARTHROPODS OF CALIFORNIA

By W. DWIGHT PIERCE

### 1. INTRODUCTORY STATEMENT

The first true fossil insect described from California was a dragon fly, *Protothore explicata* Cockerell, described from soft bluish rock of the Eocene, taken at Phillips' sawmill, five miles south of Montgomery Creek, Shasta County, collected by Ralph W. Chaney. (T. D. A. Cockerell. 1930. A fossil dragon fly from California (Odonata: Calopterygidae). Entom. News 41:49-50, pl. 6). Although we now have other insects to add to the California list, this dragon fly remains the oldest geologically.

Prior to this, however, numerous insects imbedded in the Pleistocene tar deposits of the Rancho La Brea pits in Hancock Park, Los Angeles, were listed by Fordyce Grinnell (1908. Quaternary myriapods and insects. Univ. Calif. Pub., Geology 5:207-215, pls. 15-16), although some of his names were later synonymized by Blaisdell. E. O. Essig (1931. A history of entomology: 3-9) has added a few more species.

The La Brea Pleistocene list is as follows:

#### Myriapoda

*Spirobolus australis* Grinnell, fragments.

#### Coleoptera

##### Carabidae

*Platynus* near *funeris* LeConte, a single elytron.

*Amara insignis* Dejean, two perfect elytra.

*Pterostichus* sp., several elytra (Grinnell; Essig).

*Calosoma semilaeve* LeConte, elytron.

##### Dytiscidae

*Dytiscus marginicollis* LeConte, two elytra.

##### Tenebrionidae

*Coniontis robusta* Horn, one elytron.

*Coniontis abdominalis* LeConte, two well preserved specimens.

*Coniontis puncticollis* LeConte, portion of an elytron.

*Coniontis elliptica* Casey, thorax and elytra.

*Eleodes acuticauda* LeConte, many specimens (Grinnell; Essig).

*Eleodes parvicollis* Eschscholtz (*behrri* Grinnell, perfect specimen; *intermedia* Grinnell, complete abdomen and elytra).

*Eleodes consobrina* LeConte, abdomen and elytra.

*Eleodes laticollis* LeConte, many good specimens (Grinnell; Essig).

*Elcodes grandicollis* Eschscholtz (*clongata* Grinnell), single elytron (Grinnell; Essig).

*Eleodes omissa* LeConte, many specimens (Essig).

*Eleodes* (?) *distans* Blaisdell, many specimens (Essig).

*Cratidus osculans* LeConte, two specimens (Essig).

*Nyctoporus carinata* LeConte, one specimen (Essig).

*Eulabis* probably *laticornis* Casey, one specimen (Essig).

In the same article Grinnell described two Myriapods:

*Julus occidentalis* Grinnell, from Samwel Cave, 15 miles from Baird in Shasta County.

*Julus cavicola* Grinnell, from Potter Creek Cave on the McCloud River, near Baird in Shasta County.

Essig also states that insects have been found in the tar pits at Carpinteria, Santa Barbara County, and at McKittrick, Kern County. Of the latter he mentions delicate Odonata, and the following Coleoptera:

#### Hydrophilidae

*Hydrous triangularis* (Say), abundant.

*Hydrophilus* sp. +, one specimen.

#### Dytiscidae

*Cybister explanatus* LeConte, abundant.

To date no extinct species has been found in the tar, except possibly the myriapod. The writer has examined many specimens.

and will, later in this series, list the species in the Los Angeles Museum collection from Rancho La Brea.

Essig speaks of the difficulty of recovering Odonata remains. None of these have so far been seen in the La Brea material.

The writer found a rather simple means of cleaning and separating the specimens. They are first soaked for days in gasoline, several changes; then removed to xylol for further removal of the tar. Then if carefully lifted out and dropped into absolute alcohol the last vestige of foreign matter is removed and the specimens are ready for careful mounting. Many fragments of leaves can be recovered in this way. They must be lifted on cover glass and all liquid changes from alcohol to balsam must be done on the glass. Insect chitin is not injured by the whirlpool action taking place when the specimen is plunged into the alcohol.

There are probably other fossil insects in various collections in the state or elsewhere, and we will welcome contributions to this series, two being already promised. This will have the effect of centering knowledge of California fossil insects all in one series of papers. To begin the story there are five specimens in the Los Angeles Museum and two at the University of California. At Dr. Chester Stock's request, a separate title will be given for each source lot described.

It is desired that the contributors to the series give full geological and geographic data regarding their specimens, and that the description be carefully drawn along modern descriptive lines.





## 2. DESCRIPTION OF A LOWER MIOCENE FOSSIL CARABID BEETLE, WITH A DISCUSSION OF COLEOPTEROUS ELYTRA

There have been very few fossil insects found in America, outside of the coal measures of the Eastern States, the Green River, Wyoming; Florissant, Colorado, and Kansas shales, and the more recent California tar pits. It gave, therefore, quite a thrill when Dr. Lore Rose David, paleontologist of the Richfield Oil Company sent for determination a little beetle elytron from the Cuyama River outcrop section of the upper Lower Miocene, from San Luis Obispo County. This becomes one of the first Miocene insects from California, if our information is complete, and the others are described in the next two papers of this series. The elytron, while broken off at the tip, and cracked in two places can be completely described, because the broken piece, slightly displaced lay just a bit lower and slightly under the major portion. It is exceedingly delicate, but the chitin is well preserved in its original color and texture, and even the tiny setae in the punctures are still present.

The elytron belongs to the Order Coleoptera, Family Carabidae, Tribe Bembidiini, genus *Bembidion*, in which genus one species from White River, Wyoming, Eocene; three species from Florissant, Colorado, Miocene; five species from Scarborough, Ontario, Pleistocene; one from Toronto, Ontario, Pleistocene; and one from Ohio Pleistocene have been described, in addition to many existent species. The genus is therefore over 40 million years old. Our present specimen must be 20 million years old, or older, according to paleontological reckoning. This will be the first fossil specimen in the genus from California, or the Pacific Coast.

Because of the characters of abbreviated scutellar stria, basal extension of the lateral margin, termination of the inflexed lateral area before the tip, and presence of two deeply impressed foveae on the third discal interspace, this fossil elytron must be placed in the great complex genus *Bembidion* Latreille, and according to Casey's 1918 monograph it would fall in group II, or subgenus *Ochthedromus* LeConte. In this subgenus are two California existent species, one *B. (O.) bifossulatum* LeConte being present in the same area as the fossil.

In preparing to study and describe this elytron, the writer had occasion to look up the literature on beetle elytral venation, and was astonished to find that but little had been done to correlate the striae of the elytra with the wing veins, although Comstock in his book, *The Wings of Insects*, had shown that in the pupa the tracheation for the elytra was homologous with that of the wings.

The Carabidae are the oldest and most primitive beetles, and we should therefore find in this family a rather primitive elytral venation. By a comparative study of the new fossil, and of an elytron from a modern *B. (O.) bifossulatum* the writer feels that it is time to correlate the striae of Carabid elytra with the Comstock wing vein nomenclature, and the wing areas of Snodgrass.

Snodgrass divides the insect wing into four areas: axillary region, remigium, vannus and jugum. He defines three folds which serve as landmarks: (1) the basal fold from attachment of costa and subcosta to the first axillary sclerite, by the attachment of the radius to the second axillary sclerite, to the point of attachment of the vannal veins to the third axillary sclerite; (2) the vannal fold, which separates remigium from vannus; and (3) the jugular fold, which separates jugum from vannus, and has its base in the third axillary sclerite.

In these two elytra the four regions are very clearly defined. In plate 1, figures A and B the axillary region is illustrated. Figure B shows axillary sclerites 1 and 2 quite plainly, but the third axillary sclerite was still covered by the matrix. This was later removed and figure A, shows clearly the third axillary sclerite and its relationship to the marginal rim. The basal fold is the deep depression at the base of the elytra proper, separating the disc or remigium from the axillary sclerites. The entire disc, except the outer flattened margin is the remigium. The vannal fold is rather clearly shown in figures A and C, and internally is represented by the internal plica, which terminates at about the point where the fossil wing is broken. The vannus is then the flattened rim, and contains two very closely placed striae. The outer edge represents the jugular fold, and the inflexed lateral piece, the jugum. These terms may prove very useful in our descriptive work.

In thinking over the characters of the beetle elytron a rather striking thought came, concerning which the writer has never seen any statement. In the Orthoptera, Hemiptera, Diptera, Lepidoptera, Hymenoptera, etc., when the wings are in repose, the costal margin, which is the front edge when in flight, lies at the side of the body, and the anal or vannal portion is dorsal or dorso-medial. This is also true of the hind wings of Coleoptera. But, in the elytra an entirely different arrangement exists, which probably accounts for the uselessness of beetle elytra for flight.

The axillary pieces, which are normally pleural and hence lateral, have migrated dorsally on the mesothorax, and lie close to the scutellum. This brings the costal margin to the edge of the scutellum. The normal dorsal portion of the beetle elytron is the concave inner portion when the elytra are closed; and the normal ventral portion has become the convex outer side of the elytra. They fit closely together, and function in most beetles as a body covering, and in many species have become connate. This explains how the costa of beetle elytra is median, and the costa of beetle wings is lateral. Hence when one finds a fossil with the costal margins of two wings arising close to the same point and on the same side of the two wings, the insect is not Coleopterous. This was the deciding point on one of the fossils to be described in this series.

Correlation of the striae with the Comstock venation nomenclature was settled by several fixed points.

The costal vein is diagonal and cuts off a tiny basal triangle called humeral plate by Snodgrass (note the diagonal streak on figure B), but it is in the beetle elytron no longer humeral. We might more aptly call it precostal plate. The hardened sutural margin may be called the costal margin. The first stria, called scutellar stria by Casey, is the subcosta; a short vein of a few punctures (8 in the fossil, 14 in *bifossulatum*), and does not make a cell with the next vein. Basally the interval between scutellum and subcosta is the costal interval; and between subcosta and radius, the subcostal interval. Beyond the end of the short subcosta, the interval adjoining the suture must be known as the costal-subcostal interval. The radius has a short basal stem and divides into two longitudinal veins, radius I and II (striae 2, 3), and the interval between them is then the first radial interval, and that following radius II the second radial interval. In *B. bifossulatum* the striae are clear throughout. In the fossil the apex is shining and the striae are very dim but discernible, and conform exactly with the *bifossulatum* pattern. Radius I and II are apically united, making a closed cell of the first radial interval. The third complete longitudinal vein (stria 4) is unquestionably medius I. There are two deep punctures in the second radial interval (third discal interspace), practically in the depression of medius I. These occupy different positions in the two species. All of these veins are definitely from the anterior stem. The fourth longitudinal vein (stria 5) is unattached at base, and opposite the third axillary sclerite, but slightly turned toward medius I, and may be considered as medius II. These two veins in *bifossulatum* are united before the apex to form a closed first median cell. This is dimly visible in the fossil. Opposite the transverse portion of the basal margin are three veins (striae 6, 7, 8) beyond medius II. The first is in *bifossulatum* attached to the basal margin, and is hence cubitus I, the second and third are

cubitus II and postcubitus. The intervals following medius II, cubitus I and II and postcubitus are the second medial, first and second cubital and postcubital. In *bifossulatum*, and faintly in the fossil, cubitus I is subapically united with medius I and II, thus closing second median cell. Cubitus then extends to the apex a short distance from the junction of radius I and II. This makes the second radial interval an apically open cell with narrowly truncate apex and subapical lateral prong. Cubitus II and postcubitus terminate before the apex, and their intervals are open behind. The entire area just described constitutes the remigium.

The basal margin is the anal stem, and the lateral margin is flattened at the vannal fold to form a broad rim in which lie the first and second anal or vannal veins (striae 9, 10). These unite shortly before the tip, and in *bifossulatum* the extension unites with the terminus of cubitus I. In the fossil it is the same, though very faint.

The inflexed side piece of the elytra corresponds to the jugum, with the jugular fold the dorso-lateral margin of the elytra. The posterior termination of the jugular region makes a slight notch in the margin. Internally the vannal fold is prominent and is known in Carabid literature as the internal plica. It forms a groove to lock the abdomen.

## BEMBIDION (OCHTHEDROMUS) DAVIDAE, new species

### PLATE 1

Described from a left elytron found imbedded in Upper Lower Miocene shale, Cuyama River outcrop section on the west bank of the river, near its junction with Huasna Creek, in San Luis Obispo County near center of section 27, Township 11 N, R. 33 W. San Bernardino Base Line and Meridian; in a part of the Saucesian formation, rich in foraminifera, indication of great depth; and sent in by Dr. Lore Rose David, paleontologist of the Richfield Oil Co., in whose honor the species is named. Holotype in Los Angeles County Museum of History, Science and Art, Paleontology No. S9001, and registered by the Museum under A4356.

The specimen is in unusually fine condition, with two cracks in the chitin, and the end of the elytron broken off, but present in slightly changed position. It is a very delicate specimen. Color brown, pale at tip.

Length 3.65 mm.; greatest width 1.43 mm.; sides subparallel in middle zone, gently convex to base and apex, with humeral



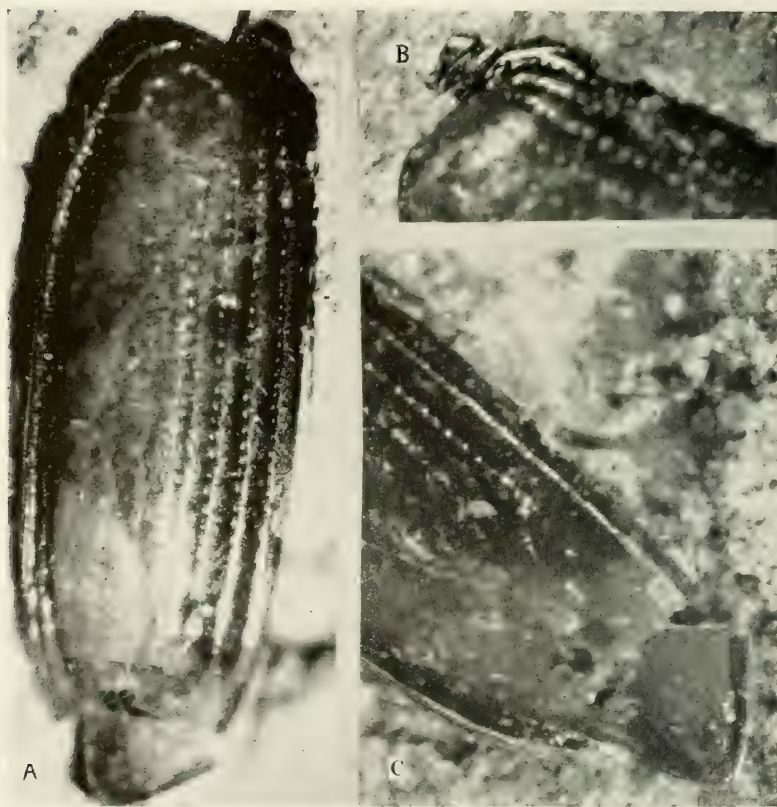


PLATE 1

*Bembidion (Ochthedromus) davidae* sp. nov., enlarged x approx. 29, Type

A. Entire elytron. B. Base. C. Apex.

Photo courtesy L. A. County Museum



angles rounded; marginal ridge beginning quite near the third axillary sclerite, at a point opposite the beginning of the sixth or cubital stria. In detail the elytron shows a strongly striato-punctate radio-medial area, and an almost smooth, faintly punctate cubital area, with all striae except the marginal, ones almost obliterated, very faintly impressed in the apical area. The two foveae characteristic of the genus are on the fourth stria, or medius I; the anterior fovea at about the basal third of the elytron; and the posterior at about the apical fourth. The basal sclerites are well defined, and form the elytral condyles. The very short costa cuts off a tiny basal precostal triangle (Snodgrass' humeral plate, but on beetle elytra no longer humeral), but the extended costal or sutural margin is sharply rimmed. The subcosta, or scutellar stria (stria 1) is short, not reaching the basal third, and consists of 8 punctures, in a deep stria. The two radial striae (striae 2, 3) are briefly united at base, deeply impressed, with coarse punctures to apical fourth, the first extending as a depression to the obtuse angled apex, where it joins the faint second radial stria. The punctation of radius II terminates a little beyond the second fovea, beyond which the impression is very faint. Medius I (stria 4) is deeply punctate to the second fovea. The first fovea intrudes upon the second radial interspace. Stria 5 which is interpreted as medius II is unattached at base, deeply punctate, but with punctures becoming obsolete before the apical third. Striae 6, 7 and 8 (interpreted as cubitus I and II and postcubitus) are unattached at base, very faintly impressed, with minute faint punctures, and the entire area is quite smooth and shining. The vannal fold is parallel with the margin and sets off the flattened marginal ledge, on which are striae 9 and 10, which become clearly separated in the posterior half, and are closely deeply punctate. The inflexed lateral area, or jugum, begins at the humerus to become wider and is widest opposite the first fovea, thence narrows to the subapical notch.

When the smooth apical area is viewed in the correct light it can be seen that all striae are faintly impressed to the apex in exactly the same pattern as described for *bifossulatum* in the introductory note; that is, with radius I and II apically united; medius I and II and cubitus I subapically united; second radial interval subapically clubbed and apically narrowly open; cubitus I united with vannus I.

Viewed under high magnification, the surface is finely transversely, reticulately striate; and the punctures of subcosta, radius I and II, and medius I and II to the apical fourth are each provided with a tiny, transparent, white scale-like seta arising from the center of the puncture. These are very hard to see, except under just the right light, because they glisten in the light. The light spots in the punctures shown in the figures are due to the lights caught by these setae.

### 3. DESCRIPTION OF A DEEP WELL LOWER MIOCENE CARABID BEETLE

A section of oil well core, from 10,450 ft. depth in Miocene oil shale, containing two beetle elytron fragments was examined some time ago by the writer, but at that time he could not place it. The better specimen described in the foregoing article gave a clue to its systematic position, and consequently the specimen is being described as a second species of *Bembidion* in honor of Miss Jane Everest, paleontologist, the owner and donor of the type material.

It is believed that this fossil insect was the deepest of any yet found.

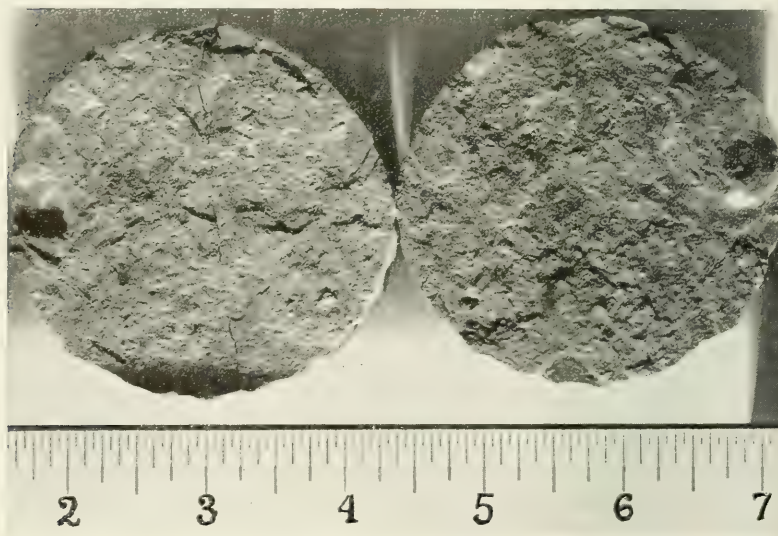


PLATE 2

Section of oil well core with *Bembidion everestae* in situ.

Photo courtesy L. A. County Museum

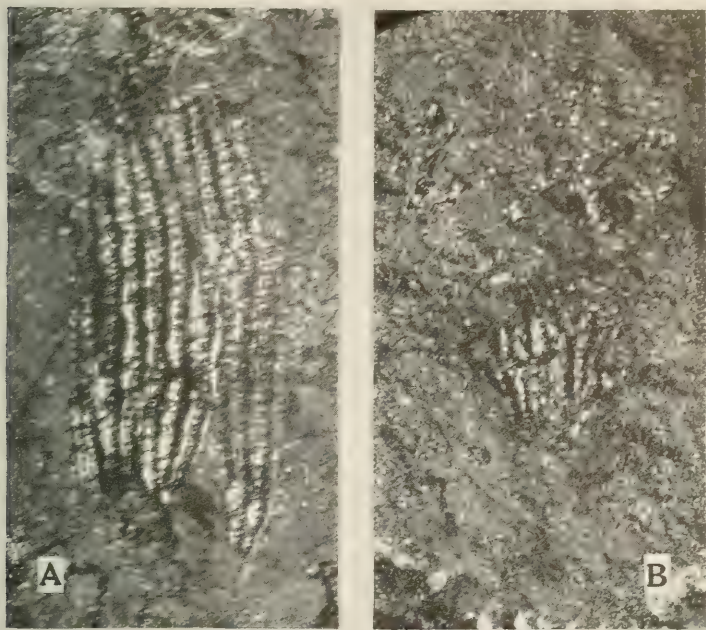


PLATE 3

*Bembidion everestae* n. sp. enlarged X approx.  $1\frac{1}{2}$ .

A. Type, elytron. B. Fragment, perhaps tip of the same elytron.

Photo courtesy L. A. County Museum

### BEMBIDION EVERESTAE, new species

#### PLATES 2, 3

Described from a fragment of an elytron, and its impression in oil shale core (Plate 2) from oil well boring of the Ohio Oil Co. well K.C.L.-G.No.1, in the Bellevue District, near town of Rosedale, 6 miles due west of Bakersfield, Kern Co., California, location 2310.1' S. and 1639.75' E. of N.W. corner of Section 36, 29 S./26 E. Monte Diablo B. & M., elevation 373.3, taken at depth of 10,450 ft. The formation is Upper Lower Miocene, Saucelian Age. Registered at Los Angeles Museum of History, Science and Art under A4709, Paleontology No. S9003.

The specimen (Plate 3) was crushed and apically split, and the basal margin of the elytron is missing. On account of the peculiarly distorted zone on the first radial interspace corresponding to the puncture usually found at this point in *Bembidion*, the species is assigned to that genus. The species differs greatly from *Bembidion davidae* in that all striae are deeply impressed and coarsely punctate throughout, and with considerable irregularity at the first fovea. This is found in the first subgenus in Casey's key, *Odontium* LeConte, to which we may tentatively assign it.

Length 4.92 mm. by 2.46 mm.

The costal and subcostal zone, as well as the axillary sclerites, are not visible. The first radial stria extends the entire length of the elytron, where it is met by radius II. The first fovea lying slightly beyond the basal third is in the line of the third visible stria, medius, I, which is broken to form an oval ring around the foveate area. The presence of this foveate area slightly changes the course of radius II and medius II. The elytron is split from about the apical third, between medius I and medius II. The cubito-vannal area contains six punctate striae, cubitus I and II, postcubitus, and vannus I, II and III, the last rather indistinct. Vannus I probably coincides with the vannal fold. As described in article 2, medius II, cubitus I and II are apically united, but the terminus of the cubital and vannal veins is missing. The vannal area forms quite a wide lateral ledge, much wider than in *davidae*.

Five eighths of an inch from the above described specimen is a tiny fragment, probably of the tip of an elytron, perhaps of the same specimen, because it is of the same sculpture. It is illustrated in figure B.

#### 4. TWO INTERESTING ORTHOPTEROIDS FROM DIATOMACEOUS DEPOSITS

In this paper a new source of insect fossils is introduced, and if the evidences on the two pairs of slabs is any indication, careful study after the war should reveal more fossil insects. On one pair of slabs there are, in addition to the wing described, fragments of two other kinds of wings.

The specimens were found by Robert K. Foster, and presented to the Cabrillo Beach Marine Museum of the Department of Playground and Recreation of the City of Los Angeles. Dr.



W. L. Lloyd, Director of the Museum, on learning that the insect remains were new to science, consented to their description and deposit in the type collection of the Los Angeles County Museum.

Dr. Chester Stock, Paleontologist of the Los Angeles County Museum, visited the site with Dr. Lloyd, and described it as a cliff of diatomaceous shale located approximately 100 feet south of an abandoned navy pier at Fort MacArthur lower reservation, approximately 3100 feet directly north of the breakwater at San Pedro, Los Angeles County, California. The specimens occur in Valmonte diatomite of the Monterey Shale, Upper Miocene.

The two insects described below represent new genera, one definitely Orthopteran, the other doubtfully so. It has very primitive characters, with certain Orthopteran features, and also certain resemblances to Coleoptera and Diptera, but cannot belong to either of these.

#### PROTOSEGESTES, new genus

Tettigoniidae, with wing tegmen of the shape found in *Segestes* of the Mecopodinae. Strong humeral plate; broad almost parallel costal area to apical third; costal area terminating or merging with radius at about apical fifth; radius deeply impressed; true remigial area apically acute; vannal area narrowly elongate, triangular; jugal fold at right angles to radial fold. Surface entirely reticulate, with small longitudinal cells.

Type of genus—*Protosegestes lloydi* Pierce

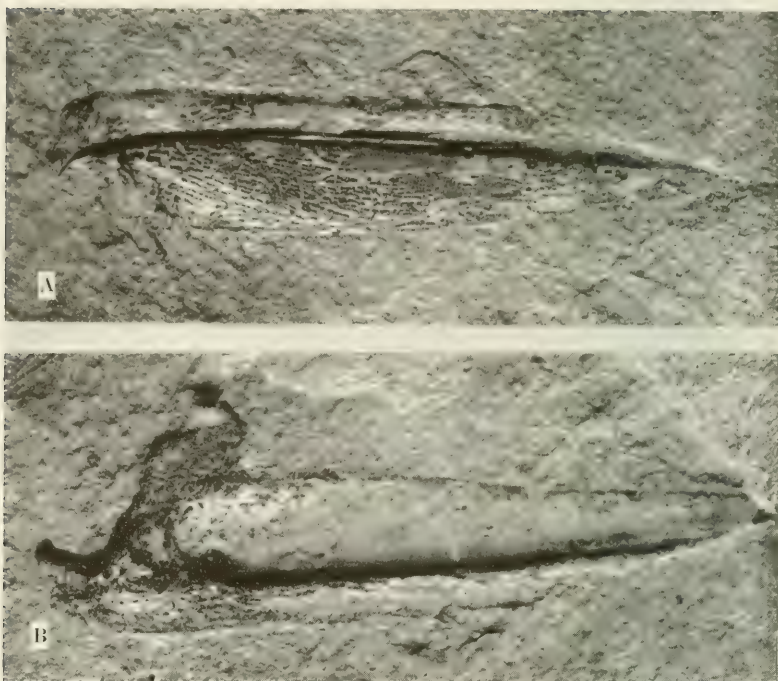
PROTOSEGESTES LLOYDI, new species

#### PLATE 4

Fossil in Upper Miocene, Monterey shale, Valmonte diatomite. Described from inner side of a tegmen and its impression, found by Robert K. Foster, and deposited by Dr. William L. Lloyd, Director of the Cabrillo Beach Marine Museum, and a Director of the Southern California Academy of Sciences, accessioned by Los Angeles County Museum under L2063, and recorded in the Paleontology Department as S9004.

Length 57.5 mm.; greatest breadth 10.5 mm.; length from costal shoulder to end of costal area 47.5 mm.; length from jugal fold to apex 53 mm.; length of vannal fold 20 mm. An elongate, strongly reticulate wing with acute apex, strong humeral plate,





## PLATE 4

*Protosegestes lloydi* n. sp. enlarged x approx.  $1\frac{1}{4}$ .

A. Front wing, inner surface, Type. B. Reverse impression of above.

Photo courtesy L. A. County Museum

broad subparallel costal area. Axillary region of first and second axillae strong, beak like. The wing proper is in reality divided into four areas, for the remigium of Snodgrass is sharply divided by a deep fold along radius, and we may call the outer portion which clasps the body the costal area, and the radio-medio-cubital area the true remigium. The vannal fold is diagonal, separating the smaller vannal or anal area; and a small jugal area is set off by a deep jugal fold. As in other Orthoptera the third axilla is below and beyond the other two.

J. H. Comstock, in *The Wings of Insects*, considers the costa in Orthoptera to be absent or rudimentary, but following Snodgrass, we may detect a small triangular basal or shoulder area set off by a short diagonal costa; and this area is known as the humeral plate. The costal margin then extends to the end of the costal area at the apical fifth of the wing. This area is broadest

at the junction of the costa with the outer margin, but is almost parallel thence to the radial fold up to the apical third of the wing, and thence is narrowed to its apex. The costal area is reticulately covered with longitudinal cells.

The deep radial fold includes basally the subcosta and radius. Subcosta becomes differentiated at about the middle of the wing, when it enters the costal area. The remigium proper is broken up into a net work of short longitudinal cells in such manner that it is impossible to differentiate the radial, medial and cubital veins. The area is broadest at the apex of the vannal fold, and rapidly narrows to an acute point at the tip of the wing. It is this acutely tipped wing which suggests relationship to the Philippine *Segestes*. The vannal area is a long, narrow triangle based in the deep jugal fold close to the radial fold, and extending almost to the middle of the entire wing; but measuring from vannal fold to apex of the wing, it only reaches to the basal third of this length. The vannal area is also filled with small, longitudinal cells. The jugal area is a small flap-like area separated by the deep jugal fold.

### EXAERETOPTERA, new genus

Name based on ΕΞΑΙΠΕΤΟΣ—picked out, chosen, peculiar, rejected, + ΠΤΕΡΟΝ—wing.

Type of new family, EXAERETOPTERIDAE, and new superfamily (or order ?) EXAERETOPTEROIDEA, placed tentatively in Orthoptera.

Four-winged insects, with fore wings shorter than the hind wings. Fore wing, or tegmen, with broad costal area, extending entire length of wing, and with a broad jugal (?) area extending far beyond the apex of the cubital cell. Subcosta and radius united to middle; medius basally united with cubitus, and beyond cubital cell, with but a single branch.

Type of genus *Exaeretopectera fosteri* Pierce

### EXAERETOPTERA FOSTERI, new species

PLATES 5, 6

Fossil wings in Upper Miocene, Monterey shale, Valmonte diatomite. Described from inside of tegmen and fragment of hind wing, and the corresponding impression; found by Robert K. Foster, and deposited by Dr. William L. Lloyd, Director of the

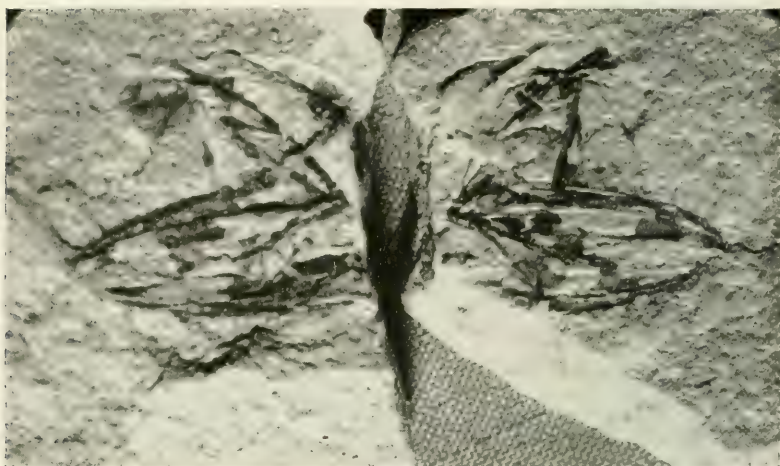


PLATE 5

*Exaeretopectera fosteri* n. sp. enlarged X 2.  
Type on left; opposing impression on right.  
Photo courtesy L. A. County Museum

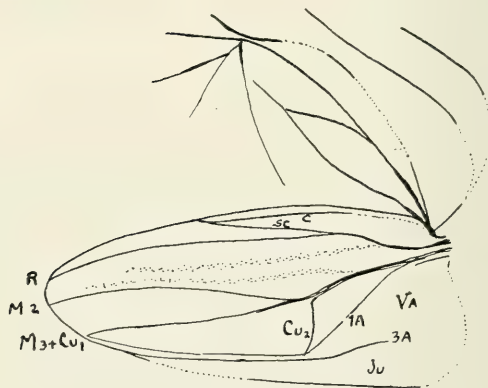


PLATE 6

Interpretation of venation of type.  
Author's figure.

Cabrillo Beach Marine Museum; accessioned under L2063, and recorded in the Paleontology Department as S9005.

These wings do not fit well into any order of recent or fossil insects, but are to be considered as Orthopteroid, because of the broad costal area and strong jugal area, which is unusually long in the tegmen. The fan-like branching of veins at the middle of the hind wing does not seem comparable to any described insect.

Length of tegmen, or anterior wing 18 mm.; greatest breadth 9 mm. Wing surface thin, brown, parchment-like with heavy brown veins. The costa cannot be traced at base, but is seen in its extension to the point of merging with subcosta. Radius and subcosta are united at base, and strongly curved, subcosta departing at crest of curve, and diagonally crossing the broad costal area. Radius is unbranched, but a depression probably indicates the radial sector, Medius, cubitus and first anal are united at base, first anal soon departing, and toward the middle of the wing cubitus 2 departs almost at right angles to form a triangular cubital cell with the first anal. Shortly beyond this cell there is a branching, the upper vein being medius 2 and the lower medius 3 + cubitus 1, both veins continuing to the apex of the wing. A depression above the medio-cubitus, which arises about the middle of the cubital cell, may indicate the course of medius 1. From the apex of the cubital cell, cubitus 2 + first anal continues along the margin of the remigium to form junction at the apex with medius 3 + cubitus 1. The triangular cubital cell is the real landmark of this wing, which identifies the surrounding veins. This cell is a common feature of Dipterous wings, and also occurs in Orthopteran fore wings. A short vein from base is probably second anal. The origin of third anal is missing, but this vein extends beyond the apex of the cubital cell close to the cubitus 2 + first anal, and becomes the marginal vein of the wing toward apex, beyond the point where the jugal margin joins it. The broad area below this is interpreted as the jugum. The only example of a jugum extending in this manner, known to the author is in the Coleoptera, Carabidae, where it is infolded.

The third wing offers too many problems for one to venture its description. Characteristic of the fragment are the broad marginal and costal areas, a basal cell in the radio-medial area and a fanning of veins at perhaps the middle of the wing. The distance from base to this fan is 13 mm., and we may assume that the wing approximates 26 mm. in length. Although the texture of the two wings is the same, it is possible that the two did not belong to the same insect.



## 5. A CRYSTALLIZED MILLIPEDE FROM VOLCANIC ROCK IN A WELL.

In the mineral collection received by the Los Angeles County Museum from the estate of General Carl F. A. Last, was a piece of basaltic lava, with crystalline calcite and quartz from the depth of 900 feet in a well at Oxnard, California.

Mr. Last was born October 17, 1861 on the Island of Rügen, and was brought by his parents to America in 1862. In 1895 he was appointed Brigadier General of the First Brigade of National Guard of California. Many of his collections were presented to the Museum.

The specimen is very interesting in that it is a perfect animal, finely crystallized in a cavity among the crystals, which had formed in the crevices in the basaltic lava.

The size of the coiled millipede is 12 mm.x7.5 mm. Uncoiled it would measure about 38 mm., 2 mm. in height of body without legs, and 2 mm. in breadth. In color it is creamy white, and there are 65 or 66 segments, the middle ones being about 0.6 mm. long.

We may tentatively place it in the family Blaniulidae, genus *Paraiulus*, in which the segments may number 65 or 66.

Because of the uncertainty of the age of the specimen, and the complete obliteration of all characters by the crystallization it is not considered advisable to give a name to the millipede.





## TWO NEW WEST AMERICAN PELECYPODS

By G. WILLETT

Los Angeles County Museum

During a study of a collection of mollusks from Upper Pleistocene deposits from the mesa at the head of Newport Bay, Orange County, California, several undescribed species have come to light. Among these are two interesting pelecypods, the descriptions of which follow.

*Cardita hilli* sp. nov. (Pl.,7). Description.—Shell small (so far as known), obliquely rounded, slightly higher than long, inflated; with 25 to 27 somewhat flattened, radiating ribs which are crossed by much less prominent concentric ribs, the junctions being slightly nodulous, particularly on the posterior slope. Spaces between radiating ribs less than half the width of the ribs, and perceptibly channeled in larger specimens. Beaks

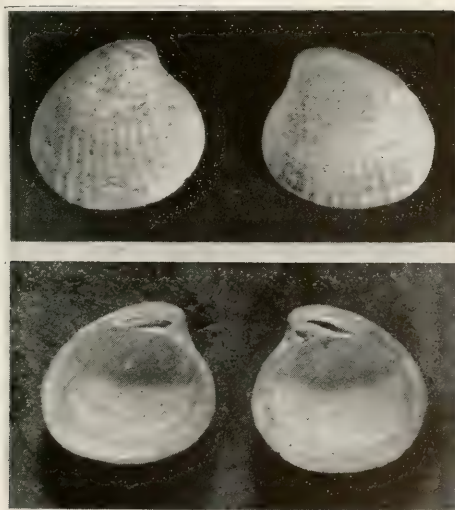


PLATE 7

*Cardita hilli*, type (X2)

Photo courtesy L. A. County Museum

prominent; hinge-plate heavy; right valve with strong, diagonal central cardinal, with weaker lamellar cardinals on each side of it; in the left valve the central cardinal is nearly vertical, the posterior lamellar tooth is divided into two, and the anterior lamellar tooth is hardly perceptible.

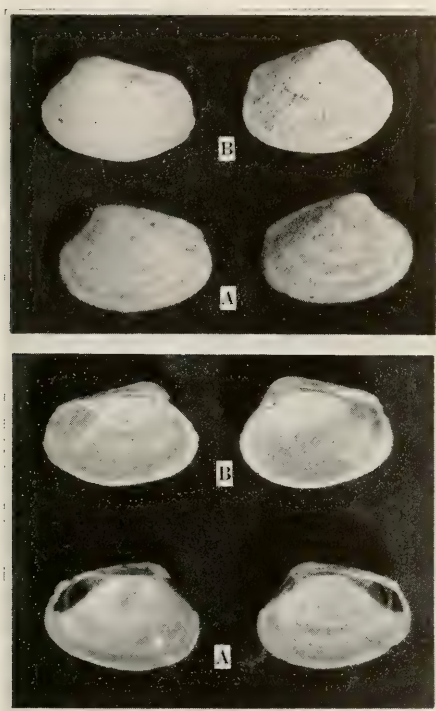
*Type*, No. 1067 Los Angeles County Museum, collected by George P. Kanakoff at South location, Upper Pleistocene of Newport Bay mesa, Orange County, California, July, 1940. Paratype in California Academy of Sciences. The type right valve measures: Long., 11.4; alt., 11.7; diam., 4.4 millimeters. Type left valve: Long., 11.7; alt., 12; diam., 4.2 mm. Our largest specimen, a right valve, measures  $13.2 \times 13.6 \times 5$  mm.

In general outline this shell is similar to exceptionally high specimens of *C. crebricostata* Krause, but it is more swollen than that species, with heavier hinge plate and finer and more numerous ribs. The latter feature alone serves to distinguish *hilli* from all similar species from this coast.

The faunal assemblage in which this species was found is characteristic of much warmer water than occurs in the region today, and it is reasonable to believe that *Cardita hilli* will eventually be found living on the coast of Lower California, probably, like the next species, in the region of Magdalena Bay. Judging by the species which accompany it in the fossil deposit, it should occur near the low-tide line in considerably more shallow water than is usual for allied members of the genus.

The writer takes pleasure in naming this species for Dr. Howard R. Hill, a long time member of the staff of the Los Angeles County Museum.

A small Venerid, apparently unassignable to any known species, was found in all of the Newport Bay fossil exposures. Furthermore, this was by no means its first appearance, as it is in our collections from several other Upper San Pedro deposits, having previously been variously labelled tentatively as the young of *Protothaca tenerrima*, Cpr., and of different forms of *P. staminea* Conr. However, as further comparison of the shell with undoubted young of *tenerrima* and *staminea* showed numerous differences, the writer became convinced that a hitherto unnamed species was represented. Consequently it was named and described, but before its publication it was learned through Dr. W. P. Woodring that Dr. W. H. Dall, shortly before his death, had distinguished and named the species from the Recent fauna of Magdalena Bay, Lower California, but that his name had not been validated by publication. Correspondence with Dr. Harold A. Rehder, of the United States National Museum, resulted in Dr. Dall's named type being forwarded to me for use in this paper. Therefore, the species may be known as:



## PLATE 8

*Chione picta* (X2)

Fig. A. type. Fig. B. fossil paratype.

Photo courtesy L. A. County Museum

*Chione picta* Dall, sp. nov. Pl. 8, figs. A, B). Description.—Shell very small, elongate-ovate, inequilateral; anterior margin short, rounded; posterior margin produced, sub-truncate; dorsal margin long; nearly straight; beaks anterior. External sculpture of bifurcating, radial ribs crossed by sharp, concentric ridges, the former being stronger on anterior and posterior margins. Escutcheon well marked, cardiform, weakly ribbed. Teeth similar to those of *Protothaca staminea*, but with anterior cardinal proportionately longer and more horizontal (nearer parallel to margin of hinge-plate). Exterior buffy white, lighter in fossils. Interior white, except for a posterior zone of deep brown (reddish in fossils), about two millimeters in greatest width, running from beneath the umbo about three fourths of the distance down the shell; the hinge, also, frequently more or less stained with brown. Pallial sinus poorly defined.

Type, No. 218340 U. S. National Museum, collected by C. R. Orcutt in Magdalena Bay, Lower California, Mexico. The type measures: Long., 10; lat., 7.6; diam., 5.4 millimeters. A paratype (No. 1068 L. A. Museum), collected by George P. Kanakoff, at the South location of upper Newport Bay Pleistocene, measures: Long., 10; lat., 7.5; diam., 5.7 mm.

Dr. Rehder informs me that the National Museum has additional Recent specimens from Cape San Lucas and Pichilínque Bay, Lower California; head of the Gulf of California, and Bacochibampo Bay, Sonora. As a fossil, the species was fairly common in the Newport Bay deposits; it was also found in the Upper San Pedro fauna of Baldwin Hills, and Mrs. Effie M. Clark has taken it in considerable numbers in the Pleistocene of Bixby Slough, Los Angeles County.

Dr. Dall (MS) placed this species in the genus *Chione*, subgenus *Timoclea*, but this subgenus lacks a differentiated escutcheon and has reduced concentric sculpture. Although in the nature of its escutcheon *picta* resembles *Chione* s. s., its outline is quite different, and the right posterior and left central cardinal teeth are bifid. In external sculpture and dentition it appears to the writer to be closer to *Protothaca*, though it differs from that genus, as now understood, in possession of a well marked escutcheon, shorter ligament, and slightly different arrangement of the cardinal teeth.

The name used here for the species is that of Dr. W. H. Dall, and should be attributed to him.



## HYDRIOMENA STUDIES I\*

## THE GLAUCATA-CROKERI GROUP

By J. McDUNNOUGH

Ottawa, Ont.

Recently I have had the opportunity of working over a large accumulation of material—mostly from California and adjacent South-western States—belonging to the Geometrid genus *Hydriomena*; this material was received through the courtesy of Dr. J. Comstock of the Los Angeles Museum and Mr. J. Sperry of Riverside, Calif. I have utilized the opportunity afforded by the identification work on these specimens to study the female genitalia of a number of the species with a view to ascertaining whether good specific characters might be found in these organs, this feature having been entirely neglected in my former revision of the genus in 1917 (B. & McD. Contributions, Vol. IV, No. 1). Surprisingly good results have been obtained and a relationship of the species brought out which supports a contention I have put forward on several occasions, *viz.*, that the present grouping, based simply on palpal length, is largely artificial.

In my present studies I am disregarding temporarily those species in which the male genitalia show a simple uncus (*furcata*, *nubilofasciata*, *speciosata*, etc.) and in which the female genitalia are much simplified and diversified; the aberrant *furculoides* B. & McD. must also be included in this group as the female genitalia show distinct affinities to those of *similaris* Hlst. The balance of the species, which form the typical section of *Hydriomena* and which all show a forked uncus in the male genitalia, possess female genitalia built more or less along the same general lines but with a number of minor modifications which form excellent specific characters. The ostium is membranous and leads into a narrow neck with chitinous collar, open on the dorsal side and forming slight "wings" as in *Eupithecia* and other allied Geometrid genera; the neck expands into a broad chitinous ductus bursae of variable length and generally much shorter on the dorsal side than on the ventral, forming dorsally a slight bulge, to the distal edge of which is attached the apex of the membranous bursa-sack; ventrally at the base of the ductus is a small membranous bulb-like appendage from which the ductus

\*Contribution No. 2300 Division of Entomology, Science Service, Department of Agriculture Ottawa, Canada.



seminalis arises. A chitinous ridge, arising from the inner ventral surface of the ductus, partially divides it into two compartments. The bursa-sack is oval or globular, membranous, and in a few species without any armature; in the majority of cases, however, there is a hollow, chitinous hood-or thimble-like protuberance situated in various positions at the junction on the ventral side of the ductus and bursa and for which I propose using the name "digitabulum." The position of this digitabulum affords one of the best characters for specific separation; it may be vestigial—*shasta* and *irata*—or well developed on the right side—*californiata*; in most cases, however, it is on the left side. In one small western group—which is the main subject of the present article—there are two digitabula, placed close together medio-ventrally; to this group belong *crokeri* Swett and the much misidentified *glaucata* Pack.; *muscata* B. & McD. may also fall here but I have seen no females of this rare species so can make no definite statements.

#### HYDRIOMENA GLAUCATA Pack.

Through the co-operation of the authorities of the American Museum of New York I have been enabled to study the unique type female of this species and make a slide of the genitalia. The type specimen is considerably worn and certain details of the cross-lines are evidently largely obliterated; the head, as noted by Swett, is also lacking. However, two features stand out, *viz.*, the generally pale yellowish-green nature of the ground-color and the very distinct dark cross-bands, numbers 2 and 5. According to the records of the Museum the specimen was taken by Hy. Edwards in Santa Clara Co., Calif.

Up to the present *glaucata* has been misidentified by all revisers. Swett's reference (Can. Ent., XLVII, 62) as a variety of *ruberata* Frey. is distinctly wrong as *ruberata* shows a type of female genitalia with only a single digitabulum. The Barnes and McDunnough doubtful reference was closer, but the figure given (1918, Contr. IV (1), Pl. VI, fig. 4) is probably that of a *crokeri* variety which seems to occur commonly throughout the Sierras and which I discuss later. I have been very fortunate in finding among the Comstock material a small series of the true *glaucata*, one male and three females from the Santa Cruz Islands, Mar. 23, 24, and Apr. 1, 1941, and one male and one female from the Santa Catalina Islands, Feb. 26 and Mar. 4, 1941, taken by the Los Angeles Museum's Channel Islands' Biological Survey party, the female genitalia being an exact match for those of the holotype of *glaucata*, which I figure (fig. 1 of Plate 10). It would appear that *glaucata* is a coastal species and does not extend far into the interior which might account for its rarity up to the

present. As this Island series is in excellent condition I have drawn up the following fresh description of the species in order to emphasize certain points of maculation not evident to Packard on account of the poor condition of the original specimen.

"Palpi distinctly long, slightly downcurved, rather smoothly clothed with fuscous hairs and scales and tinged with white baso-ventrally. Antennae dark, in male laterally flattened, rather thin and very faintly notched at joints on underside. Head, collar, patagia and metathoracic tuft largely whitish, with a faint yellowish tinge and (at times) a light sprinkling of smoky dots, most evident along upper edge of patagia and on tuft. Abdomen a pale ochreous with (as far as can be seen) little maculation. Primaries *pale yellowish-green* with the median area—between bands 3 and 4—generally paler than the other light areas and with variably distinct ruddy tinges preceding band 3 and following band 4. A small smoky basal patch below costa. Band 1 a distinct, blackish, almost rigidly outwardly oblique line, generally with a very slight incurve on vein 1. Band 2 broad, irregular, purple-gray and *very clearly defined*; in general parallel to band 1 with a strong inward angle on vein 1. Band 3 a thin black line slightly wavy, but otherwise parallel to band 1. The spaces between bands 1 and 2 and bands 2 and 3 are of the pale ground-color, the latter being frequently *tinged with ruddy*. Band 4 a thin, black line, more pronounced in the costal half of wing; it forms a broad inward angle opposite the fine, dark, discal streak, bulges outwardly on veins 3 and 4, curves inward across vein 1 and reaches inner margin much closer to band 3 than on costa. The pale median space is comparatively narrow and frequently shows dark sprinkling on both sides of the cubital vein but typically there is no trace of a dark shade along inner margin, such as is general in *crokeri*. Band 5 broad, especially in costal area, irregularly sinuate, purple-gray, the preceding pale area frequently *tinged with ruddy*. Along outer margin the ends of the veins are prominently bordered with short purple-gray streaks which show a tendency, especially below apex, to coalesce into a terminal band. A subapical black streak touching the outer margin of band 5 and another similar streak—but rather inconspicuous—below vein 6, connecting bands 4 and 5. Fringes pale in the basal half, checkered with black opposite the vein-endings, smoky outwardly.

Secondaries light smoky with small, dark, discal dot and well-defined, rather broad, postmedian and subterminal parallel lines; slight darker suffusion along outer margin and a fine dark terminal line. Fringes pale, thinly checkered with smoky."

Male Genitalia scarcely to be distinguished from those of *crokeri* and *muscata*, as figured in the 1918 revision (Pl. IX,

figs. 3 and 4); as far as can be judged from the single slide I have been able to make they are possibly closer to the figure of *muscata* than to that of *crokeri* in the shape of the uncus, the narrowing of the juxta at base and the longer and thinner finger-like transtilla-projections, but these differences may not hold when a series can be examined.

Female Genitalia (fig. 1 of Plate 10) with long, broad, chitinized ductus bursae; inner ventral ridge moderately strong and terminating in an acute point which projects into the bursa beyond and between the digitabula. The two digitabula are large, subequal and placed close together in the medio-ventral area. Bursa membranous, subglobular, the dorsal attachment being placed well back at about one-third the length of the ductus.

*Glaucata* is, without doubt, very closely allied to *crokeri* but can be most easily separated from it by its distinctly longer palpi; in general coloration it has a considerable superficial resemblance to *renunciata* var. *columbiata* Tayl. (*vide* B. & McD. Revision, Pl. IV, fig. 14) but the female genitalia of the two are quite divergent, the latter species having a single digitabulum, placed on the left side.

Two male specimens from the Santa Catalina Islands, taken along with the material already mentioned puzzle me; they show the distinct dark suffusion in the median area of the inner margin of primaries which I am inclined to associate with *crokeri*; they also appear to possess slightly shorter palpi than the other males of *glaucata* but the genitalic slide of one of them cannot well be separated from the *glaucata* slide and the general coloration and direction of the bands—notably band 1—is the same. They may well prove to be atypical forms of *glaucata* but more material, especially females, is necessary before the matter can be decided.

#### HYDRIOMENA CROKERI Swett

The typical Vancouver Island form of this species is well figured in the B. & McD. Revision (Pl. IV, fig. 15). In general the maculation of primaries is heavier than that of *glaucata* and the coloration is more contrasting; the distinct inward bend of band 1 at the costa seems characteristic and is not found in *glaucata*; a dark shade in the median area along the inner margin is mostly present but in two specimens of our series is lacking. The male genitalia have been figured in the above-mentioned revision (Pl. IX, fig. 3) and I would call particular attention to the broad basal area of the juxta and the rather stubby transtilla-projections as possible, but rather doubtful, distinguishing char-

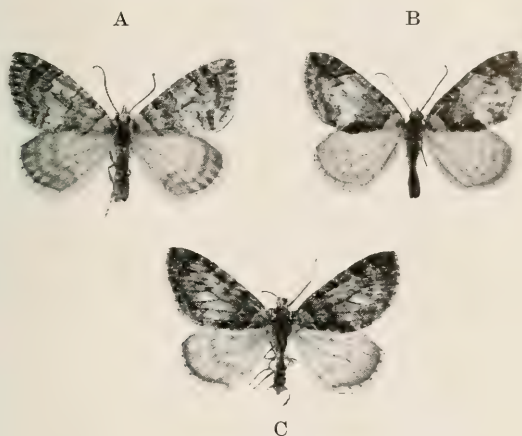


PLATE 9

- A. *Hydriomena glaucata* Pack. (Catalina Island, Cal., Feb. 26, 1941.)  
 B. *H. crokeri* var. *comstocki* var. nov. Paratype ♂. (Yosemite Natl. Park, May 7, 1937. M. L. Walton, coll.)  
 C. *H. crokeri* v. *comstocki* form *waltoni* form nov. Paratype ♂ (Yosemite Natl. Park, May 19, 1939)

Photo courtesy L. A. County Museum

acters. The female genitalia is figured here (fig. 2 of Plate 10) for the first time and it may be noted that the ductus bursae is considerably shorter and chunkier than that of *glaucata* and also that the two digitabula are placed more obliquely in relation to each other with the intervening projection of the inner chitinous ridge much reduced.

The more or less typical form extends southward at low altitudes into Oregon and I have seen specimens from the Sperry Collection from McMinnville and Medford. In the mountains and notably in the California Sierras (Yosemite) the species becomes much darker in coloration and appears to warrant the following subspecific name.

#### H. CROKERI VAR. COMSTOCKI var. nov.

Basal area of primaries before band 1 pale, with usually a distinct yellowish tinge, and at times finely sprinkled with dark atoms; antemedian area, between bands 1 and 3, almost solidly deep brown, obscuring band 2 to a great extent, with strong dark shade along inner margin and some faint ruddy suffusion; median area contrastingly pale whitish more or less sprinkled (at times quite heavily) with dark atoms, broad, with a strong outward bulge across the cell but greatly narrowed at inner margin. Sub-



terminal and terminal areas rather heavily brown-shaded with an intermixing of yellowish and ruddy shades, notably in the costal area on both sides of band 5 which is somewhat obscured by the dark shading. Fringes rather deep smoky, faintly checkered.

*Holotype*—♂, Yosemite Nat. Park, Calif., May 19, 1939 (D. Tiemann), in the Los Angeles Museum Collection.

*Paratypes*—6 ♂, same data; 5 ♂, same locality, May 6, 7, 1937 (M. L. Walton), in the above Collection and No. 5506 in the Canadian National Collection, Ottawa; 1 ♂, Yosemite N. P., May 7, 1937 (Walton), in Collection Sperry.

It is probably this race which was erroneously figured as *glauca* Pack. in the revision (Pl. VI, fig. 4). Odd specimens are in our collection from the Klamath Lake, Ore. region and from the vicinity of Lake Tahoe, Calif.

In the male genitalia the forks of the uncus are moderately thin and evenly rounded apically. The neck is short and rather broad, but occasional specimens occur in which the neck, although short, is quite thin; such specimens, while bearing the same locality data, I have not made paratypes, although I imagine this slight difference to be merely due to individual variation as I can detect nothing in the maculation to warrant specific separation.

Along with the type series a few specimens occurred in both years' (1937 and 1939) collecting which present a decidedly different facies although there are apparently no differences in the male genitalia to amount to anything; such slight differences as occur—depth of fork of uncus, width of neck, contour of juxta, etc.—may readily be ascribed to individual variation. The main difference in appearance is caused by a general smoky suffusion of the pale areas, resulting in a considerable reduction of the sharply contrasted maculation of typical *comstocki*. There is also a lack of the dark shade along the inner margin and the palish median band is narrower and of more even width throughout, due to a reduction of the outward bulge across the cell and also to a less close approximation of bands 3 and 4 at inner margin in most specimens (not, however, an entirely constant character). For this form—which might readily be confused with other species—I propose the name *WALTONI* form nov. It includes the only females I have seen which possess the *crockeri*-type of genitalia. The type series is as follows:

*Holotype*—♂, Yosemite Nat. Park, Calif., May 6, 1937 (M. L. Walton), in the Los Angeles Museum Collection.

*Allotype*—♀, same data in same collection.



*Paratypes*—1 ♀, same data as Allotype; 2 ♂, 1 ♀, same locality, May 19, 1939 (D. Tiemann), in the above Collection and No. 5507 in the Canadian National Collection, Ottawa.

In the Comstock material were included a number of specimens from the Greenhorn Mts., Kern Co., Calif., mostly females in rather poor state of preservation; these belong to the race *comstocki* and are mostly of the *waltoni* type. They were captured in 1938 on June 9 but in 1933 and '37 not until early July which probably accounts for their rubbed condition. From a study of a number of slides of female genitalia from this series it seems evident that a certain amount of individual variation in the length of the ductus (generally toward the shorter side as compared with my figure) and the shape of the digitabula must be reckoned with. This may be partially explained on the ground that it is almost impossible to obtain two slides mounted in exactly the same manner, due to the varying degrees of inflation of the bursa and the fact that it is necessary to cut open the bursa at its fundus to extract the very large and cumbersome spermatophore. The general type, however, adheres pretty closely to my figure and no great difficulty should be experienced in making correct determinations.

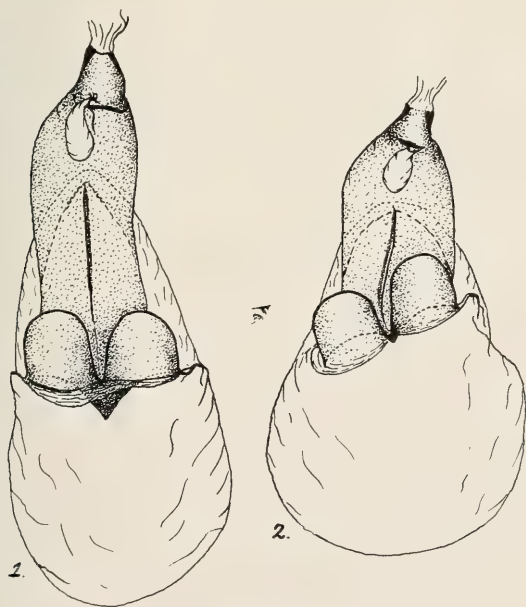


PLATE 10

Ventral view of female genitalia of 1. *Hydriomena glaucata* Pack. (Holotype); 2. *H. crokeri* Swett.

NOTES ON THE IMMATURE STAGES OF URBANUS  
TESSELLATA OCCIDENTALIS SKIN

By V. G. DETHIER

The egg, mature larva, and chrysalis of this very common skipper have been figured by Comstock (1927). Inasmuch as these illustrations depict the immature stages accurately and realistically, the following notes are intended merely as supplemental.

In Solano County, California the common food plant is *Sidalcea*. Eggs are laid singly on various parts of the plant, especially on young leaves and stems, as well as on earth and debris immediately adjacent to the plant. As a rule young larvae construct a makeshift nest of silk among terminal buds and leaves. Later instars tend to hide during the day at the base of the plant or in litter on the ground immediately beneath it. Not infrequently frail nests are constructed in this litter. Pupation occurs in much the same place. Older larvae are commonly covered with particles of sand which aid concealment. The last eggs of the season are laid late in October and require nine days for development. By November larvae have emerged; by December feeding has ceased and larvae have retired to the base of the plant to pass the winter.

## EGG:

Greatest diameter, 0.5 mm.; height, 0.4 mm. Color, pale bluish green becoming cream just prior to hatching.

## FIRST INSTAR:

Head height, 0.40 mm.; head width, 0.42 mm. Shiny piceous. Surface smooth. Few slightly clavate hairs. Others tapering. All colorless and directed forward. Length of body, 1.5 mm. Cream colored. Shield concolorous with head. Spiracles concolorous with body. Tips of legs fuscous. Prothorax darker than other segments. Hairs on body fuscous. All hairs dorsad of spiracles except those on thoracic and anal segments typically bifurcate. Arranged in para-dorsal and supra-stigmatal rows. Hairs ventrad of spiracles long and tapering. Hairs on shield long, clavate,

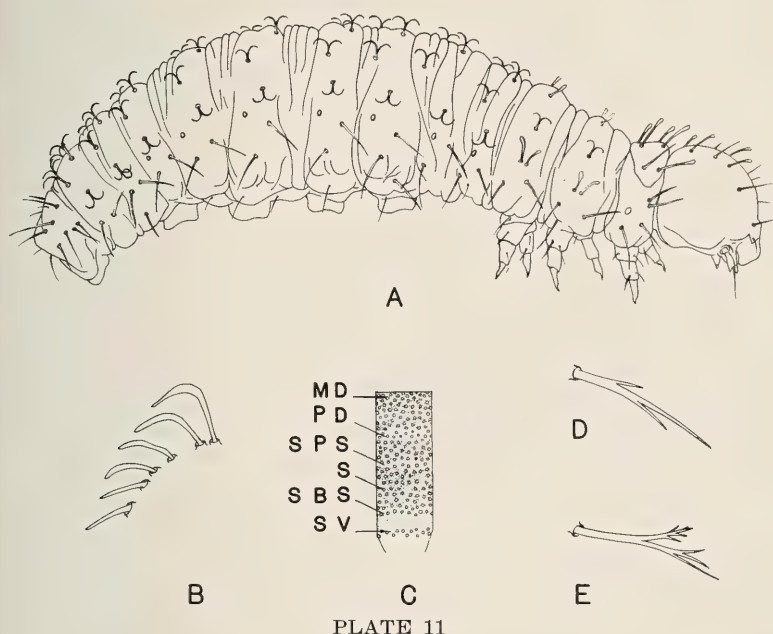


Fig. A. Lateral aspect of newly hatched larva of *Urbanus tessellata occidentalis* Skin.

Fig. B. Type of hairs found on the head of larvae in the first instar.

Fig. C. Semi-diagrammatic representation of color pattern on abdominal segments. MD, mid-dorsal line; PD, para-dorsal line; SPS, supra-stigmatal line; S, stigmatal line; SBS, substigmatal line; SV, subventral fold.

Fig. D. Type of hair characteristic of head in third instar.

Fig. E. Type of hair characteristic of head in fourth instar.

and directed forward. The shapes and arrangement of other hairs are shown in Plate 11, figure A. There is a dense accumulation of spiny fuscous hairs on the ventum caudad of the last pair of legs.

## SECOND INSTAR:

Head height, 0.55 mm.; head width, 0.57 mm. Surface roughly reticulate. Black. Hairs more numerous, coarser, shorter, elbowed at tip (Figure B), and directed forward. Length of body 4.5 mm. Yellowish except where green contents of gut are visible through the transparent cuticle. Prothorax brownish. Shield black. Legs fuscous. Numerous hairs on body. Not of

uniform length. Clavate. Arise from small white protuberances. First appearance here, in light form, of longitudinal markings characteristic of later instars.

#### THIRD INSTAR:

Head height, 0.87 mm.; head width, 0.90 mm. Head darker and more rugose than before. Hairs exceedingly numerous. Slightly branched or frayed at tips (Figure D). Length of body 6 mm. Generally light brownish in color. Longitudinal markings as in final instar.

#### FOURTH INSTAR:

Head height, 1.2-1.3 mm.; head width, 1.6 mm. Hairs more numerous, longer, and more complexly branched (Figure E). Length of body 16 mm. Darker brown than before, otherwise very similar.

#### FIFTH INSTAR:

Head height, 2.2 mm.; head width, 2.4 mm. Similar to previous instar. Hair appears as dense tawny pile. Surface of head very rough. No pronounced protuberances or angularities. Length of body 21 mm. Surface peppered with minute rounded white tubercles from which arise the hairs. The smooth background upon which these tubercles are set is brown or white. It is the variation in color of this background which makes up the longitudinal lines of the color pattern (Figure C). There is a wide mid-dorsal line, a slightly narrower para-dorsal, and a much wider stigmalal line. All brown. Between the mid- and para-dorsals is a white area through which extends a thin longitudinal brown line. There are thin white supra- and sub-stigmalal lines. The subventral fold and most of the ventum lack tubercles. The ventum is dull yellowish to greenish. That portion of the prothoracic segment anterior to the shield may be sienna or black in color. There may be an indistinct white mid-dorsal line here and a mid-dorsal bleaching of the shield. Remainder of shield black.

#### CHRYSLIS:

Length 11 mm. Wing pads light turquoise. Eyes purplish brown. Dorsum slate green. Abdomen light brownish. Scattered fuscous mottling on abdominal segments. Veins in wing pads outlined in fuscous. Hairs long and whitish.

#### LITERATURE CITED

Comstock, J. A.

1927. Butterflies of California. pp. 207-8. Figs. A67-A68.

## LAND SLUGS IN CALIFORNIA

By W. H. LANGE, JR.

University of California<sup>1</sup>

Although the land snails of economic importance in California are fairly well known there seems to be less known concerning the native and introduced slug fauna. This article is intended chiefly to fulfill a present need for a resumé of the slugs of California in anticipation of a more detailed paper on the bionomics and economics of the different species.

The slugs and snails causing extensive injury in gardens or to agriculturally grown plants are chiefly introduced species, and it is highly important that their presence in California be recognized, their present distribution, and their possible damage in the future.

Hanna (1939) listed the following exotic slugs and snails which at this time were known to occur in California: *Agriolimax agrestis* (Linnaeus); *Helix aspersa* (Müller), *Helix pisana* Müller; *Limax flavus* (Linnaeus); *Limax maximus* Linnaeus; *Milax gagates* (Müller); and *Limax marginatus* Müller (record of T. D. A. Cockerell on Santa Catalina Island).

In a recent article Gammon (1943) gives a resumé of the economically important helioid snails in California which are under eradication programs by the California State Department of Agriculture. These species include, *Helix aspersa* Müller, the European brown snail; *Helix pisana* Müller, white snail; *Helix lactea* Müller, lactea snail; *Helix aperta* Born, green or burrowing snail; and *Helix nemoralis* Linnaeus, the banded wood snail.

Native snails in the genus *Helminthoglypta* may occasionally cause damage to plants in gardens. A common species is *H. nickliniana* Lea which damages vegetables in San Mateo and Monterey counties.

Nineteen species of slugs are known from California of which ten species are introduced; eleven of the species are known to cause injury to agriculturally grown plants.

For convenience a check-list of the slugs of California is presented followed by a short discussion of each species from the economic, distributional, and field identification aspects.

<sup>1</sup> Acknowledgment is made to R. J. Waste for records contained in his M. A. thesis (unpublished, Univ. of Calif. Library); Dr. Wendell O. Gregg for the use of records contained in his mimeographed notes in the "Conchological Society of Southern California"; to Dr. G. Dallas Hanna and Allyn G. Smith of the California Academy of Sciences who determined some of the slugs and snails and furnished notes on others; and to A. R. Mead for records of *Ariolimax* prior to publication of his revision.



CHECK LIST OF CALIFORNIA LAND SLUGS  
CLASS GASTROPODA

Subclass Pulmonata

Order Stylommatophora

Family TESTACELLIDAE

*Testacella haliotidea* Draparnaud, 1801

Family ARIONIDAE

*Anadenulus cockerelli* (Hemphill), 1890*Ariolimax columbianus* (Gould), 1851*Ariolimax columbianus stramineus* Hemphill, 1891*Ariolimax dolichophallus* Mead, 1943*Ariolimax californicus* Cooper, 1872*Ariolimax californicus brachyphallus* Mead, 1943*Arion hortensis* (Férussac), 1819*Arion circumscriptus* (Johnston), 1828*Arion intermedius* (Normand), 1852*Binneya notabilis* (Cooper), 1863*Hesperarion hemphilli* (Binney), 1876*Hesperarion niger* (Cooper), 1872*Prophysaon andersoni* (Cooper), 1872

Family LIMACIDAE

*Deroceras agreste* (Linnaeus), 1758*Deroceras laeve* (Müller), 1774*Deroceras gracile* (Rafinesque), 1820*Limax maximus* (Linnaeus), 1758*Limax flavus* (Linnaeus), 1758*Limax marginatus* (Müller), 1774*Milax gagates* (Draparnaud), 1801

*Testacella haliotidea* Draparnaud.—This is a carnivorous species feeding largely on earthworms. Its range includes western and south-western Europe and South Africa, extending into Germany, Switzerland, and Belgium. It has been introduced locally on the Atlantic coast of North America. In California it is known from a small area in Alameda county, although it may be more widespread with more intensive search. This slug has a small, external, posteriorly located, auriform shell, the ground color is

creamy-white, the back with brown diffusion, and it has two dorsally located longitudinal furrows.

*Anadenulus cockerelli* (Hemphill).—This obscure slug was described from the Cuyamaca Mountains in San Diego County, California, and was known only from the type series until recently when W. O. Gregg (Minutes of the Conchological Club of Southern California No. 25, p.8, mimeo.) found several additional localities in Los Angeles and Orange counties. This is a small species attaining 28 mm. when extended. The mantle has two undulating, longitudinal, yellow stripes which may be bordered by black stripes. It appears superficially like a small specimen of *Prophysaon andersoni*, but the tripartite condition of the sole in *Anadenulus* will serve as a ready differentiation.

*Ariolimax* (Mörch), 1860. —This genus contains several species of large yellowish to olive-brown slugs which are characteristic of the Pacific coast of North America. The excellent paper by Mead (1943) has greatly advanced our knowledge of this group.

*Ariolimax columbianus* (Gould).—This slug, sometimes referred to as the "giant redwood slug", occasionally invades gardens and feeds on vegetables and other plants. Its range extends from Alaska to southern California. In California it occurs from Del Norte County in the north to the islands off the coast of southern California, and invades the mountains of California. Records obtained by the author, and from other reliable sources indicate the following California distribution by counties: Alameda, Butte, Contra Costa, Del Norte, Eldorado, Humboldt, Lake, Marin, Mendocino, Napa, Placer, San Francisco, San Luis Obispo, Santa Clara, Shasta, Solano, Sonoma, Trinity, and Tuolumne. From Monterey County south to San Luis Obispo County, and extending into the islands off the coast of California, the subspecies *stramineus* Hemphill is the form found. *Stramineus* is also known from Santa Cruz, Santa Rosa and Santa Catalina Islands. This slug is one of the largest of the North American species reaching a length of 260 mm. The color varies from almost black in certain coastal localities to straw colored; the lightest form being *stramineus*. A spotted form occurs, with a characteristic dark spot on the mantle and irregularly placed dark spots.

*Ariolimax dolichophallus* Mead.—This slug is limited to a rather narrow range from northern Santa Cruz and western Santa Clara counties south to the Salinas Valley. Its butter yellow color is characteristic, but the extreme length of the attenuate apical phallus, as reflected in its name, is the salient feature. It has not been observed causing any economic damage.

*Ariolimax californicus* (Cooper).—This slug occasionally invades vegetable fields and gardens occurring within its range, but the damage is usually not extensive. Its distribution is limited to a localized area in San Francisco, San Mateo and Santa Clara counties. It is a bright yellow-brown to yellow slug, and may attain an extended length of 200 mm., has no spotted form and the longitudinal grooves on the body are more indistinct than in *A. columbianus*. The subspecies *brachyphallus* is limited to the San Francisco peninsula, and differentiated from typical *californicus* by internal characters.

*Arion* Férussac.—This genus is European in origin, but through commerce and other agencies has spread into North America and into other localities. The species in California are more or less obscure, and do not cause the extensive damage to agricultural crops that is reported for them in Europe. These slugs are rather corpulent, there is no suggestion of a dorsal keel, and the sole is not tripartite and extends beyond the open, caudal, mucous pore.

*Arion hortensis* Férussac.—This species is confined naturally to central Europe, but has spread throughout the world. Taylor (1907) reports it in England as a garden species feeding on the bulbs of lilies, chrysanthemums, pansies, celery, strawberries, and potatoes. In California it occurs in greenhouses where it occasionally causes damage. In the United States it is reported from Massachusetts, New York, Oregon, Washington, and Washington, D. C. In California it occurs in the San Francisco bay region. This species attains a length of about 30 mm. and is characterized by the bright orange mucus which covers the gray and black integument.

*Arion circumscriptus* Johnston.—This species must be a recent introduction into California. Specimens were collected in Golden Gate Park, San Francisco, California, on November 6, 1940, by the author, about the bases of potted *Eugenia* plants. A. G. Smith (in correspondence) reports it as being widespread in the San Francisco Bay region. This slug is easily distinguished by the white sole and clear slime, and the dark lateral bands on each side of the mantle extending down the back on each side. It attains a length of 30 mm.

*Arion intermedius* Normand.—The hedgehog slug.—Taylor (1907) reports this species in Europe as being naturally purely fungivorous, but mentions that it is also herbivorous and carnivorous. It is reported from Great Britain, Germany, France, North Italy, Switzerland, Russia, Scandinavia, Portugal, and the Azores. It has been introduced into New Zealand, and in Cali-

fornia is reported from Alameda and Ventura counties. This species attains a length of 20 mm., and has yellow slime. It is easily recognized when the animal is at rest by the pointed, dermal protuberances.

*Binneya notabilis* (Cooper.)—This slug is found on Santa Barbara Island off the coast of California, and as a fossil on San Nicholas Island. It is not known from the mainland.

*Hesperarion* Simroth, 1891.—This genus includes two species of rather obscure, native slugs which have been little known in California.

*Hesperarion hemphilli* (Binney).—No economic injury is known to occur from this slug, although in the laboratory they have been kept alive for a year on carrots and potatoes. It was originally described from Niles, Alameda County, California. During February, 1940, the author found the species for the first time since the original description, under willow leaves along a creek at Tunitas Canyon, San Mateo County, California. It has since been found in Monterey and San Benito counties, and on June 7, 1941, at Niles, the original type locality. W. O. Gregg (Minutes of the Conchological Club of South California No. 25, p.8, mimeo.) has recently extended its range to Los Angeles and Orange counties in southern California. This slug attains a length of about 30 mm., is a dark gray or brown, with lighter mantle dotted with blotches of black pigment. The caudal mucous pore is a conspicuous open slit.

*Hesperarion niger* (Cooper.)—No economic injury is known to be caused by this slug. It inhabits wooded hillsides, where it is commonly found under logs or rocks, particularly in places where moisture is present during most of the year. It is known only from California and is reported from the following counties: Alameda, Colusa, Lake, Marin, Napa, Monterey, San Benito, San Mateo, Santa Clara, and Tehama. Attaining a length of 50 mm. it is distinguished from *hemphilli* by the gray or black spots arranged irregularly along the medial third of the sole. In color it varies from brown with darker spots to almost black.

*Prophysaon andersoni* (Cooper). The reticulated slug.—This slug is primarily fungivorous and is usually found associated with old fallen logs in moist habitats. In the laboratory it was satisfactorily kept on a diet of potatoes and carrots. In Oregon Lovett and Black (1920) report damage to young plants and vegetables especially about woodpiles. It is primarily a species of the western coast of North America being found from Alaska to southern California. Its distribution in California by counties is as follows: Alameda, Contra Costa, Humboldt, Mendocino,



San Diego, San Francisco, San Mateo, and Santa Cruz. The color of this slug is variable, from light gray to blue-black, it attains a length of 65 mm., has the body set with diamond-like reticulations, and the mantle usually has two laterally placed black bands. A most distinctive characteristic is the constriction around the tail about one-fourth the length back from the end of the tail.

*DEROCERAS* Rafinesque, 1820.—This genus includes three species one of which causes considerable losses to garden and field planted vegetables and other plants. They are characterized by the closely set concentric striae of the mantle. The generic name *Agriolimax* has been widely used for these species.

*Deroceras agreste* (Linnaeus). The gray garden slug.—In California this is one of our commonest and worst pests of garden and field crops, especially in the coastal, humid sections. It is a Palaearctic species which is now distributed into every country occupied by European peoples. It was early introduced into the United States. In California records are available from the following counties: Alameda, Butte, Calaveras, Los Angeles, Monterey, Napa, Sacramento, San Bernardino, San Francisco, San Mateo, Tulare, and Ventura. This is a smaller slug, varying in length from 35 to 50 mm., and the color is very variable ranging from buff to brown or gray, with varying amounts of dark pigmented spots which may coalesce in some specimens. The milky slime which is exuded when the animal is touched is a characteristic feature.

*Deroceras laeve* (Müller). The long-necked slug.—This almost cosmopolitan slug seems to be most abundant in the San Francisco bay region where it invades gardens in association with *D. agreste*. Its known distribution in California includes Alameda, Monterey and San Francisco counties. The long neck of this slug when it is extended, almost as long as the mantle, is a characteristic feature. It attains a length of about 32 mm., and in live individuals the mantle appears to have a circular area of orange-brown coloration. The slime is clear, and it moves with a great deal more rapidity than *agreste*.

*Deroceras gracile* (Rafinesque). The gray field slug.—The range of this species is unknown, but it is known to occur in all parts of the United States. In California it is chiefly a field and lawn inhabiting species and its full economic status is not known. In California it is known from the following counties: Alameda, Kings, Los Angeles, San Diego, San Mateo, Sutter, Tehama, and Ventura. This is a small slug seldom attaining an extended length of more than 25 mm., is buff to almost black in color, and



the neck is much shorter than in *laeve*. The slime is clear, unlike *agreste*. In nature it moves with unusual speed.

LIMAX Linnaeus, 1758.—Three European species of economic interest in California are included in this genus.

*Limax maximus* Linnaeus. The spotted garden slug.—This is a widely distributed species found throughout Europe and Asia Minor, and introduced into the United States, Mexico, Cape Colony, Australia, Tasmania, New Zealand, and the North Atlantic Islands. It prefers human habitations, and although a fungus feeder by preference is practically omnivorous often causing injury to garden plants. It is not as successful as *L. marginatus* in California, is not abundant and has solitary habits. Records in the literature are often confused with *L. marginatus*. Its known distribution by counties in California is as follows: Alameda, Calaveras, Los Angeles, San Bernardino, San Diego, San Francisco, and Santa Clara. In appearance it is a yellowish-gray or brown with large, irregular black spots, and may range around 100 mm. in length although it can approach 200 mm. in length. The mantle of mature specimens is dark spotted, but these spots may be united into bands in immature specimens.

*Limax flavus* Linnaeus. The tawny garden slug.—A widely distributed species, this slug ranges throughout temperate Europe and the lands adjacent to the Mediterranean Sea. It has been introduced into North and South America, Australia, New Zealand, Japan, China, and South Africa. It is widely distributed in the eastern and southern parts of the United States and was recorded from California in 1903. This slug is associated with the habitations of man, occurring under garbage cans, in basements, wells, drains, doorsteps, etc., and about nurseries. Some damage is caused to garden plants although they will feed on fungi and refuse. The gregarious habits of this slug are very noticeable. The known California distribution by counties is as follows: Alameda, Butte, Los Angeles, Orange, San Bernardino, San Diego, San Francisco, San Mateo, and Ventura. The tawny slug is a large species ranging in length from 75 to 115 mm., is of a yellowish-green color with yellow spots, and the slime is yellow when the animal is disturbed. The ocular tentacles are bluish which also serves to distinguish it from other large slugs. The mantle consists of a series of concentric grooves giving it a reticulated appearance.

*Limax marginatus* (Müller).—The economics of this slug in California are not fully known, for although they are fungus feeders, they also feed on garden plants and underground tubers. This is one of the most widely distributed slugs in California,

showing a great deal of adaptation to different climatic conditions. It is a European species which has been introduced into Australia, New Zealand, and North America. In California records indicate its occurrence in the following counties: Alameda, Butte, Kern, Kings, Lake, Los Angeles, Madera, Modoc, Orange, Riverside, San Bernardino, San Mateo, San Diego, Santa Barbara, Sutter, Tehama, Tulare, and Ventura. It attains a length of from 50 to 75 mm., and has a ground color of light brown with gray and black bands. In immature specimens there are three longitudinal bands on the mantle, but in mature individuals the middle band tends to disappear.

*Milax gagates* (Draparnaud). The greenhouse slug.—The greenhouse slug is a cosmopolitan species which was early introduced into North America where it was recorded as early as 1872. This is a very destructive species to nursery, garden, and field crops in California. Its burrowing habits make it a pest of root crops. California records include the following counties: Alameda, Kern, Lake, Los Angeles, Napa, Sacramento, San Bernardino, San Diego, San Francisco, San Mateo, Stanislaus, Tehama, and Ventura. Attaining a length of from 40 to 70 mm., it is usually black or dark gray and is characterized by a single oval or diamond-shaped groove centered on the mantle. Other color variations occur. The keel is sharp and extends the full length of the back behind the mantle.

#### LITERATURE CITED

GAMMON, EARLE T.

1943. Helicid snails in California. Bul. State Dept. Agr. Calif. 32(3): 173-187, illus.

HANNA, G. DALLAS

1939. Exotic Mollusca in California. Bul. State Dept. Agr. Calif. 28(5): 298-321, illus.

LOVETT, A. L. and A. B. Black

1920. The gray garden slug. Ore. Exp. Sta. Bul. 170: 40-42.

MEAD, ALBERT R.

1943. Revision of the giant West Coast land slugs of the genus *Ariolimax* Mörch (Pulmonata; Arionidae). The Amer. Midland Naturalist. 30 (3): 675-717, illus.

TAYLOR, JOHN W.

1907. Monograph of the land and freshwater Mollusca of the British Isles. vol. 2, xx+312 pp., Taylor Brothers, Leeds, illus.

## COLLECTING AND PRESERVING LAND SLUGS

By WENDELL O. GREGG, M. D.

The present paper is written in response to numerous requests for information on preparing and preserving land slugs. During the past several months I have repeatedly been called upon to write to individuals giving them the instructions contained in the following paragraphs. It is hoped that by making this information more generally available there will be a greater effort on the part of our local naturalists and field collectors to obtain material and data on this most interesting subject, limacology.

**COLLECTING SLUGS:** There are certain precautions to be observed in collecting land slugs which do not concern one when collecting land snails. One must avoid against their drying up. I well recall two little black slugs taken in Soledad Canyon which were apparently different from anything else I have ever seen. They were placed in a dry, tin, pocket-size Raleigh tobacco can. That evening when I examined the day's catch, these two specimens were as dry as "bones." As I have learned since, when this does happen, the specimens can be restored sufficiently for study and identification. Soak the dried specimens in water for 12 hours; then preserve in 70% alcohol. The container I generally use now for collecting slugs is a one pound coffee tin with a tightly fitting lid. Sufficient crumpled newspaper is added to loosely fill the can. The newspaper is then thoroughly moistened, replaced in the can and in a few minutes the excess of water is poured off. In the absence of wet paper, a handful of wet leaf mould serves very well but very small slugs may easily be overlooked in leaf mould. Do not punch holes in the tin. The slugs will get sufficient oxygen unless too many specimens are crowded into one container. This precaution about punching holes in the tin applies particularly when one is collecting small specimens. I have seen specimens of *Hesperarion* and *Anadenulus* escape through minute openings very much smaller than their apparent body diameter when fully extended. When collecting the larger slugs, particularly *Ariolimax*, a proportionately larger container is appropriate and there is not the danger of the larger slugs drying up.

It is a bad practice to place small slugs in the same container with snails or other animals. If placed with empty snail

shells, small slugs will invariably crawl inside the shells and thus get lost. I once placed a small specimen of *Anadenulus* in the same container with a salamander. Upon my return I found the slug badly mutilated. I suspect the salamander of having tried to swallow the slug.

Definite locality records and other data as well as habitat notes should be kept on all material collected. Whether collected in dry weather, wet weather, in the rain, etc., is all important. Most of the introduced species are more active at night and may be seen crawling about the yard if one goes out with a flashlight. I have taken slugs from such diverse habitats as a rodents burrow and a cavity in a rotten tree trunk (still standing) twelve feet above the ground. All this information is of value and should be recorded.

**PREPARING AND PRESERVING SLUGS:** It is first necessary to kill them in a fully extended position since if dropped directly into a preserving fluid they will suddenly contract and secrete much viscid mucus. The result will be specimens which are next to worthless for study purposes. I have found drowning the most practical method of killing slugs preparatory to preserving them. They should be placed in a large jar full of water from which all air has been excluded. I prefer a two quart Mason jar with a "Vacu-Seal" type lid. The time required for drowning depends on several factors as size of slug, species of slug, temperature, etc. It varies from 12 to 72 hours. If placed in the preserving fluid before they are completely drowned they will contract and secrete mucus. If not placed in the preserving fluid soon after drowning, decomposition will ruin the specimens. When they appear fully extended and relaxed they may be taken out of the water and tested in the following manner: Touch the specimens with a pair of forceps or other object and if no contractions are noted touch them with a drop of the preserving fluid. If any reaction is noted they should be placed back in the drowning jar for several more hours.

I have most extensively used ethyl alcohol for preserving slugs. Since the present war-time restrictions on the use of ethyl alcohol, I have been using isopropyl alcohol with equally good results. The drowned slugs should be placed first in 25% alcohol for 12 hours. At the end of this time they are placed in 50% alcohol where they should be left for 24 hours or more. From the 50% alcohol they are transferred to 70% alcohol where they are permanently preserved.

If alcohol is not available, 4% solution of formaldehyde may be employed. To one part of commercial formaldehyde (40%)

add 9 parts of water. This makes a 4% solution. The slugs may be placed directly into the 4% formaldehyde. This becomes cloudy in a few days and should be discarded and fresh solution added. This then generally remains clear for a number of months. As a preserving fluid I have found formaldehyde solution inferior to alcohol.

In preserving very large slugs, better results may be had by also injecting small amounts of the preserving fluid directly into the body cavity with a hypodermic syringe. Preserved slugs should not be over crowded in their container. Always be sure that the volume of the preserving fluid is several times the volume of the slugs. Full data with catalogue numbers should be recorded on a paper label either with pencil or typewriter and placed directly in the preserving fluid with the specimens since gummed labels attached to the outside of the glass container generally come loose and either get lost or mixed.

The above method of preparing and preserving slugs is essentially that recommended by Dr. Henry Pilsbury (see Proc. Phila. Acad. Nat. Sci., 1898, p. 255).





## THE REPTILE ASSOCIATES OF WOOD RATS AND CONE-NOSED BUGS<sup>1</sup>

By SHERWIN F. WOOD

1015 North Alexandria Avenue, Hollywood 27, California

### INTRODUCTION

The search for insect and mammal vectors of Chagas' disease or American human trypanosomiasis in the southwestern United States has brought the writer into contact with some interesting reptiles. Wood rat houses evidently furnish a good retreat for many forms as well as a food supply since they harbor many kinds of insects and arachnids. Not all of the reptiles seen in the course of tearing down houses of wood rats (*Neotoma* spp.) were captured as the writer was frequently too busy collecting cone-nosed bugs (*Triatoma* spp.) to chase a lizard or snake that escaped from the pile of twigs, sticks, cactus pads, cow chips, etc. Furthermore, the presence of catclaw and mesquite stems, cactus pads and loose spines renders the grabbing technique hazardous at times. The writer and his assistants have carefully searched over 548 wood rat houses throughout the Southwest.

Wood (1941a) described briefly the method used for exposing the insect inhabitants of wood rat houses. Additional descriptions of houses harboring cone-nosed bugs infected with *Trypanosoma cruzi* Chagas were reported by Wood (1941b). An excellent account of the dens of the white-throated wood rat, *Neotoma albigula albigula* Hartley, has been recorded by Vorhies and Taylor (1940). Vestal (1938) has very ably described the houses of *Neotoma fuscipes annectens*. The houses of *Neotoma* vary greatly over the range of territory occupied by the following reptiles.

### OBSERVATIONS

Western Gecko, *Coleonyx variegatus*. One adult was collected 31-V-40 near Congress, Yavapai Co., Arizona from a *Neotoma a. albigula* house in which 2 *Triatoma rubida* nymphs and the remains of 1 ♀ *T. rubida* in the web of a black widow

<sup>1</sup>The writer wishes to thank Mr. C. B. Perkins and Dr. L. M. Klauber of the Zoological Society of San Diego for advice on nomenclature, Dr. Alden H. Miller of the University of California for specific identifications of the Arizona fence lizard and striped fence lizard, and Mr. George Willett of the Los Angeles Museum for the identification of the gray shrew.

spider were found. Another adult was collected in another wood rat house from the same area on the same day. Three adults were taken 1-VI-40 from *Neotoma a. albigula* houses at the Alvarado Mine, near Congress Junction, Yavapai Co., Arizona. Three more adults were collected 21-XII-40 from wood rat houses at the Alvarado Mine. Vorhies and Taylor (1940) found this lizard once in their survey of 100 rat dens (houses).

Arizona Rock Uta, *Uta ornata symmetrica*. One adult was taken 13-VII-36 in a brush pile house between Raso and Bowie, Cochise Co., Arizona. Vorhies and Taylor (1940) found from 1 to 3 individuals of *Uta* spp. in 6 per cent of the dens of the white-throated wood rat.

Sage-brush Swift, *Sceloporus graciosus graciosus*. All specimens were taken from brush pile wood rat houses in Kane Co., Utah. One adult was captured 5-VIII-36 under a scrub cedar 7 miles north of Kanab, another was taken 8 miles north of Kanab from a house in which 1 adult ♂ *Triatoma protracta* was collected, another adult was captured in a *Neotoma lepida lepida* house and another specimen was seen 8 miles north of Kanab.

Arizona Fence Lizard, *Sceloporus consobrinus*. One adult was collected 26-VII-36 in a wood rat house 7 miles southwest of Santa Fe, Santa Fe Co., New Mexico.

Striped Fence Lizard, *Sceloporus elongatus*. Two adults were taken 5-VIII-36 in one brush pile wood rat house 20 miles north of Flagstaff, Coconino Co., Arizona.

Western Fence Lizard, *Sceloporus occidentalis biseriatus*. Specimens of this lizard were seen on 1- to 8-V-33 in *Neotoma fuscipes macrotis* houses in Murray Canyon, San Diego Co., California. One adult was collected 28-VII-37 near Eaton Canyon Dam, Pasadena, Los Angeles Co., California from 1 *Neotoma fuscipes macrotis* house harboring 10 *Triatoma protracta* nymphs and 3 *Gerrhonotus multicarinatus webbi*. Vestal (1938) reports another subspecies of this lizard "hunting flies on houses" of the dusky-footed wood rat.

Desert Scaly Lizard, *Sceloporus magister magister*. One adult was collected 5 to 10 miles west of Victorville turnoff to Palmdale, San Bernardino Co., California on 7-IV-36 in a *Neotoma 1. lepida* house. Two adults were captured 6- and 7-VII-36 in cactus houses of *Neotoma a. albigula* near Broadway and Craycroft Ave's., Tucson, Pima Co., Arizona. One adult was taken 3-VIII-36 six miles southwest of Sedona, Yavapai Co., Arizona in a stick and horse dung house of *Neotoma a. albigula*.

in which *Triatoma rubida* was found. One immature was collected 10-IV-37 near Palmdale, Los Angeles Co., California in a *Neotoma l. lepida* house. One adult ♂ and 1 immature ♀ were collected 2-VIII-39 in a wood rat house 2.6 miles south of Faysville, Hidalgo Co., Texas in association with a ♀ gray shrew, *Notosorex crawfordi*. One adult ♀ was taken 1-VI-40 from a *Neotoma a. albigula* house near Congress Junction, Yavapai Co., Arizona. Two adults, ♂ and ♀, were taken 1-VI-40 from a boulder and twig house 5 miles west of Wickenburg, Maricopa Co., Arizona in which 4 *Triatoma rubida* were found. Vorhies and Taylor (1940) reported this species from 3 per cent of the *Neotoma a. albigula* dens examined.

Other species of *Sceloporus* were observed as follows: 1 adult lizard 17-VII-36 in 1 stick and horse dung wood rat house 8 miles northwest of Bosque Bonito, Hudspeth Co., Texas; 1 adult 24-VII-36 in a brush pile house of *Neotoma a. albigula* at the base of a juniper near Red Hill gas station, 13 miles west of Carrizozo, Lincoln Co., New Mexico; and 1 adult 26-VII-36 in a stick-stone-horse and cow dung house of *Neotoma l. lepida* 13 miles southwest of Las Vegas, San Miguel Co., New Mexico.

Arizona Short-horned Lizard, *Phrynosoma douglassii hermandesi*. One lizard was collected 21-VII-39 five miles south of Silver City, Grant Co., New Mexico from a wood rat house in a small species of oak.

Southern California Alligator Lizard, *Gerrhonotus multicarinatus webbi*. Three shed skins of this lizard were found 26-VIII-37 in 3 rat houses from which *Triatoma protracta* were collected in Murray Canyon, San Diego County. One western fence lizard and 2 alligator lizards were collected 28-VIII-37 near Eaton Canyon Dam, Pasadena, Los Angeles Co., from 1 *Neotoma fuscipes macrotis* house from which 10 *Triatoma protracta* were taken. A third alligator lizard escaped from this house. In another house from which 22 *T. protracta* (1 infected with *Trypanosoma cruzi*) were collected, 1 alligator lizard was caught. One lizard was seen in 1 rat house 23-IV-39 in the upper end of Eaton Canyon, near Pasadena, Los Angeles County. One small lizard was collected 10-XI-43 five miles southwest of Fallbrook, San Diego Co., from a wood rat house in which 2 *Triatoma protracta* nymphs were found. All specimens were from California. Vestal (1938) found 1 alligator lizard, *Gerrhonotus coeruleus* subsp., in a house of the dusky-footed wood rat.

Sonoran Alligator Lizard, *Gerrhonotus kingii*. One specimen was found 11-VII-36 in a brush pile house of *Neotoma a. albigula* in Pinery Canyon, near Dos Cabezas, Cochise Co., Arizona.

Yucca Night Lizard, *Xantusia vigilis*. One adult was captured 4-IV-36 in a wood rat house near Tecopa, Inyo County. Three specimens were collected 30-V-37 from 1 house and 2 each from 2 other wood rat houses near Neenac, Los Angeles County. One lizard was taken 14-VIII-37 with 1 immature *Neotoma l. lepida* from a house 12 miles south of Victorville, San Bernardino County. One adult was captured 22-III-41 in a rat house near Llano, Los Angeles County. All specimens were from California.

Arizona Night Lizard, *Xantusia arizonae*. One adult was collected 30-V-40 under a rock slab of a granite boulder with 1 ♀ *Triatoma longipes* at the Alvarado Mine, near Congress Junction, Yavapai Co., Arizona.

Black-throated Whiptail Lizard, *Cnemidophorus melanotethus*. One adult was collected 3-VIII-36 from a *Neotoma a. albigula* house of sticks and horse dung 6 miles southwest of Sedona, Yavapai Co., Arizona. Vorhies and Taylor (1940) found 1 *Cnemidophorus* sp. in 1 den of the white-throated wood rat.

Sonoran Whiptail Lizard, *Cnemidophorus perplexus*. One adult was collected 5-VIII--36 in a brush pile wood rat house 20 miles north of Flagstaff, Coconino Co., Arizona.

Skink, *Eumeces* sp.? One blue-tailed skink was seen 26-VII-39 in 1 wood rat house along the north side of the Chisos Mountains, 68 miles south of Marathon, Brewster Co., Texas.

Spotted Night Snake, *Hypsiglena ochrorhynchus ochrorhynchus*. One adult was taken 3-VIII-39 from 1 pack rat house  $3\frac{1}{2}$  miles west of Bruni, Webb Co., Texas. One adult was captured 4-VIII-39 with 7 *Triatoma gerstaeckeri*, 7 *T. heidemanni*, and 1 *T. protracta woodii* nymphs plus the abdomen of 1 ♂ *T. gerstaeckeri* in a rat house 23 miles south of Catarina, Webb Co., Texas.

Sonoran Tantilla, *Tantilla nigriceps*. One adult was taken 17-VII-36 in a wood rat house 9 miles northwest of Bosque Bonito, Hudspeth Co., Texas.

Black-tailed Rattlesnake, *Crotalus molossus molossus*. One adult was captured 12-VII-36 in a large brush pile wood rat house in Pinery Canyon, near Dos Cabezas, Cochise Co., Arizona.



## DISCUSSION

Vestal (1938) records 1 western yellow-bellied racer, *Coluber constrictor* subsp., and 3 western garter snakes, *Thamnophis ordinoides* subsp., besides the lizards mentioned above as encountered in his study of 590 *Neotoma fuscipes annectens* houses.

Vorhies and Taylor (1940) mention *Pituophis sayi* as a visitant of the dens of the white-throated wood rat.

One interesting amphibian, a narrow-mouthed toad, *Gastrophryne texensis*, was collected 3-VIII-39 from a wood rat house 4 miles east of Aguilares, Webb Co., Texas.

As is noted above, *Triatoma* were found in rat dens harboring the western gecko, western fence lizard, sage-brush swift, desert scaly lizard, southern California alligator lizard and the spotted night snake. Although cone-nosed bugs were not found to be abundant in the wood rat houses harboring lizards in certain localities, many *Triatoma* have been collected in these areas as Eaton Canyon and Murray Canyon in California, near Congress Junction and Sedona in Arizona, along the north side of the Chisos Mountains in Texas and near Kanab in Utah. Do these reptiles eat the bugs and thus act as control agents of the vectors of Chagas' disease? One *Gerrhonotus multi-carinatus webbii* was collected from a *Neotoma fuscipes macrotis* house harboring *Triatoma protracta* naturally infected with *Trypanosoma cruzi* in California.

## SUMMARY

Sixteen species of snakes and lizards were found in the houses of wood rats. Cone-nosed bugs were present in wood rat houses harboring the western gecko, sage-brush swift, western fence lizard, desert scaly lizard, southern California alligator lizard, and spotted night snake.

## BIBLIOGRAPHY

- Vestal, E. H. 1938. Biotic relations of the wood rat (*Neotoma fuscipes*) in the Berkeley hills, Jour. Mammal., 19, 1-36.
- Vorhies, C. A. and W. P. Taylor. 1940. Life history and ecology of the white-throated wood rat, *Neotoma albigula albigula* Hartley, in relation to grazing in Arizona. Ariz. Agr. Exp. Sta. Tech. Bull., 86, 455-529.
- Wood, S. F. 1941a. A method of collecting and transporting cone-nosed bugs. Bull. Brooklyn Ento. Soc., 36, 137-139. 1941b. Notes on the distribution and habits of Reduviid vectors of Chagas' disease in the southwestern United States (Hemiptera, Reduviidae) Pan-Pacific Ento., 17, 115-118.



# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,

Los Angeles 7, Calif., U. S. A.

---

## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

●      ●

## Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1943, including volumes XXIV to XLII, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

### MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939.

# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 1, 1926 .....	2.00	4.00
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50
" 42, " 1, 2, 3, 1943 (each) .....	.25	.50
" 43, " 1, 1944 .....	.25	.50

*(Continued on next page)*

# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ “ “ printed on one side of page (bound) .....	2.75	4.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published)...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall ....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfami- lies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....	\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....	.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....	3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis	.50

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES  
(Care DR. JOHN A. COMSTOCK)

Los Angeles Museum, Exposition Park,  
Los Angeles 7, Calif., U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

#### Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of..... Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

#### Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.....), here describe the property or ground rent.....), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# P R I N T I N G

Books • Catalogs • Broadsides  
Stationery and Office Forms



## McBRIDE PRINTING CO.

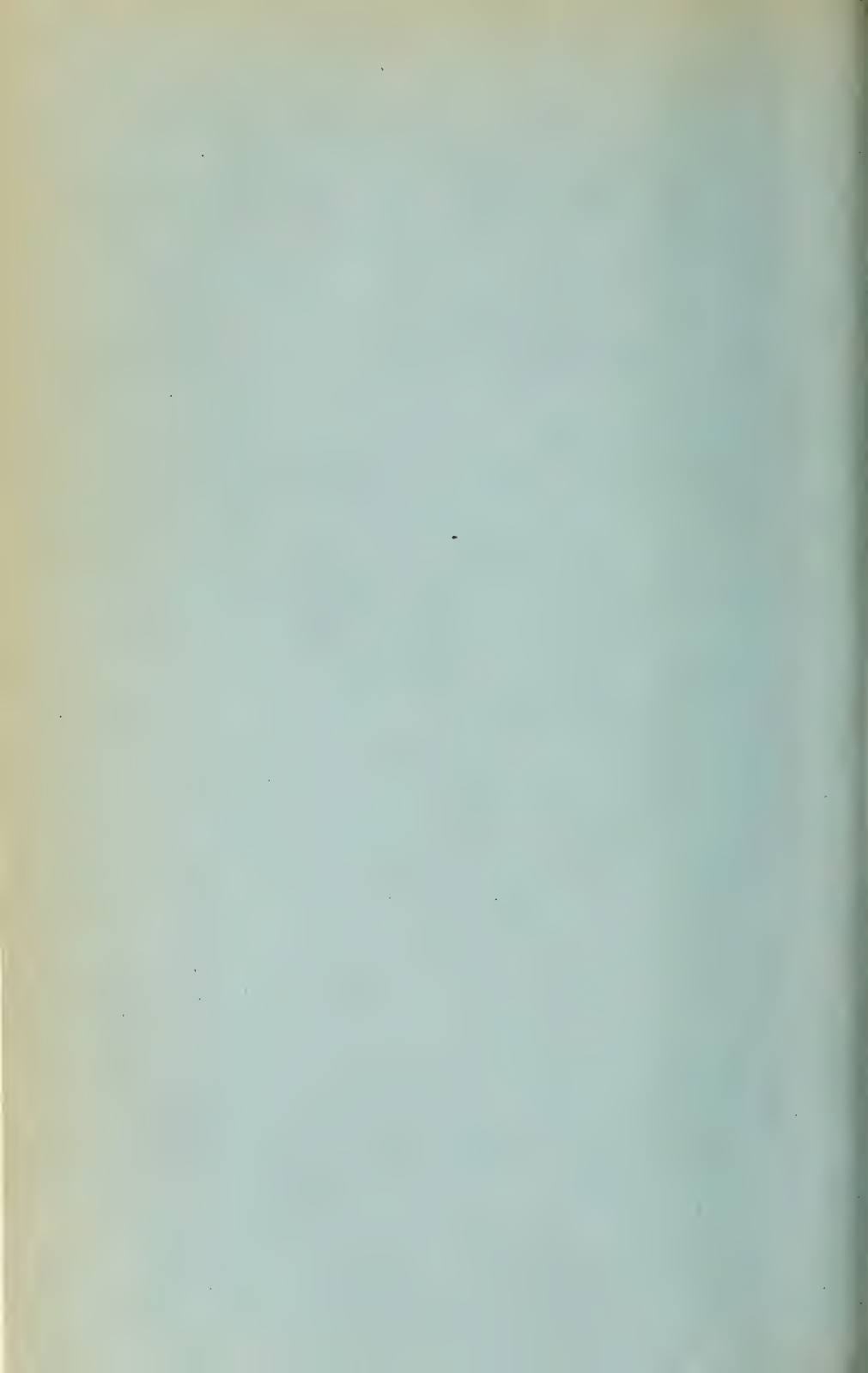
PHONE: P R o s p e c t 2045

415 EAST ELEVENTH ST.

Los Angeles 15, Calif.

*"Since 1879"*





# BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

*Mostra tuedimur ipsi.*



VOL. XLIII

MAY - AUGUST, 1944

PART 2

## CONTENTS

SOME CALIFORNIAN CHILOGNATHA:	Page
Dr. K W. Verhoeff	53
NEW SPECIES OF MOLLUSKS FROM REDONDO, CALIFORNIA:	
G. Willett	71
MISCELLANEOUS AVIAN FOSSIL RECORDS FROM CALIFORNIA:	
Hildegarde Howard	74
ENTOMOPHOBIA:	
W. Dwight Pierce	78
FOUR CALIFORNIA MOTHS ASSOCIATED WITH CAT-TAILS:	
John A. Comstock	81
THE LARVA AND PUPA OF ARZAMA GARGANTUA DYAR:	
John A. Comstock and Charles M. Dammers	84
NOTES ON THE FOOD OF REPTILES WITH SPECIAL REFER- ENCE TO THEIR POSSIBLE CONTROL OF CONE-NOSED BUGS	
Sherwin F. Wood	86

Issued Sept. 30, 1944

Mailed Oct. 31 1944

# Southern California Academy of Sciences

## OFFICERS and DIRECTORS

DR. W. DWIGHT PIERCE-	- - - - -	<i>President</i>
DR. H. J. ANDREWS -	- - - - -	<i>First Vice-President</i>
DR. WILLIAM L. LLOYD -	- - - - -	<i>Second Vice-President</i>
DR. JOHN A. COMSTOCK.	- - - - -	<i>Secretary and Treasurer</i>
DR. H. J. ANDREWS		DR. WILLIAM L. LLOYD
DR. A. WIER BELL		MR. THEODORE PAYNE
DR. JOHN A. COMSTOCK		DR. W. DWIGHT PIERCE
MR. SAMUEL MOODY HASKINS		DR. ROBERT L. RUTHERFORD
DR. HOWARD R. HILL		MR. R. S. WOGLUM

## ADVISORY BOARD

MR. FRED E. BURLEW	DR. CHESTER STOCK
MR. A. YORK ESCALANTE	DR. R. H. SWIFT
DR. SHERWIN F. WOOD	

## BOTANICAL SECTION

MR. THEODORE PAYNE, *Chairman*

## SECTION OF HEALTH AND SANITATION

DR. H. J. ANDREWS, *Chairman*

## SECTION OF ZOOLOGICAL SCIENCES

DR. A. WIER BELL, *Chairman*

## SECTION OF CHEMICAL SCIENCES

DR. HARRY J. DEUEL JR., *Chairman*

## SECTION OF EARTH SCIENCES

DR. CHESTER STOCK, *Chairman*

## SECTION OF PHYSICAL SCIENCES

DR. PRESTON K. CAYE, *Chairman*

## SECTION OF AGRICULTURAL SCIENCES

MR. RUSSELL S. WOGLUM, *Chairman*

## SECTION OF JUNIOR SCIENCE

DR. WILLIAM L. LLOYD, *Chairman*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT, *Chairman*

## FINANCE COMMITTEE

MR. FRED E. BURLEW, <i>Chairman</i>	
MR. SAMUEL MOODY HASKINS	DR. JOHN A. COMSTOCK

## PROGRAM COMMITTEE

DR. ROBERT L. RUTHERFORD, <i>Chairman</i>	DR. HOWARD R. HILL
---	--------------------

## HOSPITALITY COMMITTEE

MISS BARBARA LOOMIS, *Chairman*

## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK, <i>Chairman</i>	
DR. CHESTER STOCK	DR. WILLIAM L. LLOYD

## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif.

## SOME CALIFORNIAN CHILOGNATHA

## DIPLOPODA ARTICLE 142

By DR. K. W. VERHOEFF

Pasing, near Munich  
with 14 illustrationsCALIFORNIBOLUS n. g. and the position of this genus  
under the Spirobolidae

In spite of the considerable size of many Spiroboloidea, they are at present one of the least known groups of diplopods, the reason being that the older descriptions are quite useless today and that even to the present time, the gonopods, which are of especial importance for the knowledge of forms, have generally been insufficiently studied. Another difficulty is that the views on the morphological evaluation of the several parts of the gonopods differ greatly, because the authors as a rule did not undertake sufficient preliminary comparative morphological investigations.

Therefore we are not yet sufficiently well informed concerning the families which are to be distinguished among the Spiroboloidea. Today we are certain only that we have to differentiate between Spirobolidae and Rhinocricidae with separated posterior gonopods and without a sternite of the same and Trigoniulidae, in which the posterior gonopods are connected by a sternal structure. As the Rhinocricidae are distinguished by a protruding process of the sternite on the anterior gonopods, it is evident that *Californibolus* (n.g.) can only belong to the Spirobolidae. (See the gonopods illustrated in Figs. 1 to 3.)

In a view of Mjæberg's Australian Diplopoda in "Arkiv för Zoologi" Vol. 16, No. 5, Stockholm 1924, I already discussed on pages 93-99 the comparative morphology of the gonopods and especially that of the anterior ones, which up to that time had been but slightly touched upon and which are not of such a simple structure as it may appear to a superficial observer.

I also called attention to the importance of the muscles, which up to that time had only been taken cognizance of by me. For the correct interpretation of the parts of the anterior gonopods, certain muscles are all the more important, as the coxites of these gonopods have the tendency to more or less split into segments.

J. Carl in his "Diplopode von Neu-Caledonien und den Loyalty Inseln" Roux and Sarasin Nova Caledonia, 1926, describes among a fauna of 49 diplopods the surprisingly great number of 28 Spirobolidae and placed them all into the genus *Spirobolellus*, in which however he distinguished 13 "groups." Carl claims that "of all morphological characters, the form of the posterior gonopods is the most reliable one;" while supposedly "the anterior gonopods principally furnish indications of species." If, however, one examines critically his illustrations of the anterior and posterior gonopods, one would arrive at the conclusion that the anterior gonopods are much more diversified in structure than the posterior gonopods.

Unfortunately Carl has consistently given only the contours of the gonopods but has nowhere discussed the muscles and therefore has not entered upon the more intimate relation of the parts. Neither have the more delicate features of the structural relations been touched upon and this holds good for both pairs of gonopods. Since Carl had 28 kinds of Spirobolidae at his disposal, one might expect that he would have at least examined one in greater detail. But one learns nothing at all about whether there exists in the posterior gonopods an arrangement for the reception of sperm or for the conduct of gland secretions.

As to the relation of *Californibolus*, n.g., I wish to emphasize immediately that no relation exists with *Spirobolellus* (not even in the loose sense of Carl) neither as regards the anterior, nor the posterior gonopods. A closer investigation of the 13 groups of Carl is impossible for the reasons that on the one hand the anterior gonopods have not been dissected sufficiently and on the other hand because the key to the groups has not been arranged according to dichotomic divergences and for that reason is not a true key. As to the genus key, which has been developed for the Spirobolidae by C. Attems in "Kueckenthal's Handbuch der Zoologie." Vol. 4, Berlin, 1926, page 194, he cites in the second place a contrast according to the position of the pores of the defensive glands, which in most genera occur on the metazonites—that is, behind the sutures—and only in *Spirobolus* and *Oxobolus* in front of sutures. In *Californibolus*, to be sure, the pores occur in front of the suture, yet close to them.

In O. F. Cook's key, Proc. of U. S. Nat. Museum, Vol. 40, page 147-167, 1911, No. 1810, page 150 for six genera of American Spirobolidae, the gonopods are not considered at all. Keeping in mind, however, that in *Californibolus* the collum back of the antennae is not indented, Cook's key refers to *Anelus*, a genus which can easily be differentiated by the lack of coxal processes on the anterior pairs of legs of the male.



In 1923, Chamberlin in Proc. California Academy of Sciences, Vol. 12, No. 18, described an *Onychelus nigrescens*, from islands in the Gulf of California, which likewise does not show closer relationship to *Californibolus*. The descriptions of the gonopods (as far as they exist at all) are always very insufficient in the American data, so also in Chamberlin's "Notes on West Indian Millipedes," Proc. U. S. Nat. Museum, Vol. 61, No. 10, 1922.

Only *Prospirobolus* Att. with pores in front of the sutures would come into consideration as possibly related to *Californibolus*, according to Attem's key to the Spirobolidae of the Indo-Australia myriapods, Archiv fuer Natur, Berlin, 1914, page 298. But on page 337 he calls this genus questionable as regards its family relationship. One species of this genus (*Prospirobolus*) from China was described in 1896 by H. W. Broelemann in Mem. Soc. Zool. de France IX, Table XIII as "*Spirobolus*" *joannisi*. The gonopods (the anterior ones are insufficiently known as to their comparative morphology) at all events differ considerably from those of *Californibolus*, especially as to the base of the supports of the posterior gonopods which protrudes in a very unusual manner with a strong process posteriorly towards the gonopods.

According to this discussion it is at present extremely difficult to establish a sufficient characterization of any genus of the Spiroboloidae; and keeping in mind the many shortcomings of the literature to date, this diagnosis must necessarily be a preliminary one.

#### CALIFORNIBOLUS, new genus

The terminal segment of the antennae with four olfactory cones. The posterior gonopods (Fig. 2 and 3) appear to be unsegmented on superficial observation and in all events they do not possess a deep constriction such as is noted in the Rhinocricidae, neither is there a splitting of the end into two branches, while the sternite of the anterior gonopods appears to be in the shape of an arrowhead, that is, has no terminal protruding process. Anal valves of usual structure without depression, preanal segment posteriorly without process formation. The pores of the defensive glands are in front of the suture but as a rule touch it. Sutures of the diplosomite dorsally usually distinct. Third pair of legs of male with club-shaped coxal projections, 4th to 6th pair with simple rounded processes. Anterior part of head with  $4 + 4$  to  $5 + 5$  labral grooves. Coxites of anterior gonopods low, transversely extended, consisting of two parts, a smaller external and a much larger internal one (cti, Fig. 1). The telopodites, arranged obliquely towards the interior are simple and adapted in their length to the interior main coxal part. The posterior gono-

poes are strongly hook-shaped, (Figs. 2 and 3) and much shorter than their long supports, which are movable which enables them to turn toward the gonopods. Although the posterior gonopods are not divided into two segments by a constriction, nevertheless three divisions may be distinguished, coxite (ct), prefemurofemur (pff), and tibiotarsus (tt). Inside and anteriorly in the border region of the tibiotarsus and middle region there occurs a depression (fo) Fig. 2.

CALIFORNIBOLUS MICHELbacheri, n.s.

Male 60 mm. with 93 pairs of legs (1), male 65 mm. with 95 pairs of legs (1) Female 70 mm. with 91 pairs. (1).

Body brown with dark brown bands on posterior margin of diplosomite. Back rather glossy. Ocelli flat, round, arranged in six rows from front to rear. Head capsule smooth, only crown densely punctate. Vertex with median groove, also front of head, between the vertex and the frons, one third of the length of head without groove. Collum with rounded lateral lobes, anterior and posterior margin converge laterally at an angle of about 60 degrees. Anterior margin laterally with groove which turns somewhat posteriorly on outside. Collum finely punctate. Second body segment extending under the sides of collum and hollowed out at this point. Sutures of the body segments dorsally diminished, nevertheless pronounced almost throughout the back. Pores fairly large, situated anteriorly and at the same time close to sutures. Above the pores the suture generally makes an angular bend to the front.

The extensive longitudinal grooving of the metazonite ceases, however, somewhat below the pores, also on the prozonite, where it is finer and closer and the lower anterior portion bends upward. Thus the back remains entirely free from longitudinal sutures. The diplosomites, moreover, are dense and finely punctuated, occasionally also wrinkled. The telson without processes, the pre-anal segment on the dorsal posterior portion obtuse angled. Anal valves with inner margin bulged and with a longitudinal depression in front of it. Telson punctuated. The third pair of legs of male with clubbed coxal projections; the clubs are bent outward and forward, but in front of them and beneath their projection is a second shorter projection. On the 4th pair of legs likewise coxal projections, but simply rounded without club-like expansion, also on the 5th and 6th pairs, but here the processes are shorter.

As to the gonopods, it may be stated at once that they have been examined in their natural and macerated state and that samples in both conditions have been compared. Figs. 1-3 have

been sketched from samples in the natural state. In Fig. 1 those two muscles (m1 and m2) have been figured which move the telopodite as flexor and extensor and prove by their position that this structure truly represents the telopodite (te), which, however, in this genus is not subject to any doubt.

The sternite of the anterior gonopods (only partly shown in Fig. 1-V) as a whole has almost the shape of an inverted V, however, the terminal portion visible in Fig. 1 represents a triangle with almost right angled terminal corner, so that there is no process formation at the end. The basal lateral portions, however, form narrow arms, fused at the proximal end with an elongated support, about the same length as the outer piece of the coxite. Between the support and sternite there occurs a delimiting crease permitting a certain movement of the two organs against each other. By a terminal process the supports are also fused with the outer parts of the coxae. The large inner portion of the coxa (cti) is inserted in the posterior part of the sternite and contains at its inner base a hook-like process bending to the outside, serving for the attachment of the muscles (only easily recognized in the cleared specimens). The middle and the basal margins of the sternite are thickened. As a whole the coxites, which do not quite meet in the median line, are placed decidedly transversely, so that the outer and inner parts, separated by an incision below the insertion of the telopodite, lie absolutely alongside of each other. The inner part is located behind the triangle of the sternite and the outer part behind its side arm. While the outer part with the extensor of the telopodite shows no peculiarities, the inner part is distinguished by small scattered protuberances on its lower surface. Its end margin is sharply cut off transversely at the inner side and bevelled off on the outer side, so that there results a flat obtuse angle. On the hidden upper side of the coxal inner piece there are found two distinguishing characters—namely, basally a rounded-off plate (y Fig. 1) projecting outward, which apparently is connected with the guidance of the posterior gonopods and terminally on the inner margin a longitudinal ridge (e) for which the same may be said. The telopodite, whose diameter changes but little is bent horn-like towards the inside and crowded toward the inner piece of the coxite, so that it reaches almost as far in, as the latter. The telopodite has on its base in the depth a process to which the strong radiated flexor (m2) attaches and at the termination of the end a spoon-shaped cavity, otherwise a few gland pores at the extreme end. It is remarkable that the gonopods of this genus do not have tactile setae, neither on the anterior nor on the posterior ones.

As to the posterior gonopods (Figs. 2 and 3) nothing attracts the observer more favorably than the extreme length of the posterior supports, which exceeds that of the gonopods three times

and thus differ strongly from the anterior supports. These long supports allow the development of very strong musculature and indicate that in spite of their relatively small size, the posterior gonopods must be very active. There is a joint (g Figs. 2 and 3) between the posterior gonopods and their supports, which originates as an enlargement of both parts, which grip each other, while at the same time the parts themselves are connected by strong bands.

As already stated, I distinguish three parts on the posterior gonopods of which the basal or coxal (ct) is by far the least developed. It has a decidedly rudimentary character and can only be recognized as such (coxal) by comparison with other genera of the Spirobolidae.

The two other segments, prefemurofemur and tibiotarsus are much more strongly developed and are more distinctly set off from each other. Their limits are mostly expressed by a deep acute angled indentation on the inside and viewed posteriorly (Fig. 3) it is observed that the two segments are strongly set off from each other on the outside, for the longitudinal ridge formed by the prefemurofemur stops suddenly slantingly wedged into the end club (ei) at a considerable distance from the outer margin. The front view (Fig. 2) on the other hand shows more complicated conditions. Here the prefemorofemur projects inside with two margins—i.e., one (i), visible in profile and another far back—forming with its end (e) an almost right angled corner. Since both margins strongly converge, their common end likewise represents one of the limits separating prefemorofemur and tibiotarsus. In the front view, however, one observes at the limit of these two segments a pocket (fo), which becomes noticeable partly by an oval frame, partly by a ridge back of it (pl) partly by some skin folds but may be recognized also by foreign bodies (see Fig. 2) easily caught in it. I have no doubt whatever that this pocket physiologically corresponds to that warty area (area papillata), which I have previously described for the related Trigoniulidae. Both structures serve for the reception of sperm, but with this difference that in Trigoniulidae the sperm is caught and retained on a projecting "inner arm" by rough surfaces, while here on the other hand it must be collected in a posterior depression. The prefemorofemur contains a bent canal (see r Fig. 2), ending in the pocket already mentioned. Besides the support I was able to observe a gland canal (cdr Fig. 3) to the coxite. The junction of the two canals, however, I could not observe, not even in the macerated preparation owing to the thickness and heavy pigmentation of the adjoining parts, as the canals fade too much. As far as the tibiotarsus of the posterior gonopods is concerned, it forms a club bent semicircular, which with a



sharpened process is bent back so much that the end of the process lies in the direction of the coxite. The inner half of the tibiotarsus is provided posteriorly with scattered fine spines.

*Habitat.* Several pairs of these Spirobolidae I received from Mr. A. E. Michelbacher, Assistant in the College of Agriculture in Berkeley, California, for which I herewith express my special gratitude. He collected them May 19, 1935, in the vicinity of Fort Seward.

### CALIFORNIULIDAE, a new family of *Symphyognatha*

In the 10th number of my work on Diplopoda in the "Compendium Bronn's Klassen und Ordnungen des Thierreichs, Leipzig, 1930" (Classes and orders of the animal kingdom) I divided the Symphyognatha into the two super-families Arthropora and Oncophora. Of the differences between the two super-families I shall here mention only one—viz., that on the anterior gonopods of the Arthropora always occur lengthy telopodites, movable by muscles, while in the Oncophora these telopodites generally are absent and are never moved by muscles. According to this and several other characters the new family of Californiulidae, to be discussed here belongs to the Oncophora, as may also be recognized in Figs. 4 to 13.

Under the Onchophora, I distinguished in 1930 four families: Leucogeorgiidae, Preridoiulidae, Paectophyllidae, and Iulidae.

Of geographical importance is the fact that up to the present no endemic representative of the Oncophora from America has been known, a fact which lends additional interest to the new family.

The following may be cited as especially important characters of the Californiulidae:

1. The second to sixth segments (Fig. 7) of the antennae are distinguished by their length and a gradual club-like thickening.
2. The genae of the male are conspicuous on account of extraordinarily large lobes, which project semicircularly.
3. The sides of the collum are folded back.
4. Between the longitudinal grooves of the Metazonite occur many scattered skin gland-pores.



5. The penes (Fig. 8) are not only provided with setae in an unusual manner, but they are further distinguished in that the openings of the seminal ducts are far in front of the end of the penes (a).

6. While the first pair of legs of the male, when superficially observed shows the form prevailing among Iulidae, it is nevertheless structurally different in that at the base of the telopodite, the prefemur, shows an extraordinary breadth, only slightly less than that of the coxa.

7. The anterior gonopods (Figs. 10 and 11) are characterized at the end by a many-pointed structure and on the inside in front of it by a hairy area.

8. The posterior gonopods (Figs. 12 and 13) are characterized by two muscles in their interior, pointing to an origin from three segments. A process just anterior to the distal end possesses a pseudoflagellum.

9. The epipharynx is distinguished by a crosspiece with several lobes (Fig. 4) and the mandibles by the plurality of teeth of the outer tooth structure (Fig. 5) and the presence of at least 10 comb-like lamellae.

10. The gnathochilarium is not only remarkable for its special breadth, but also because the promentum (pr Fig. 6) runs through to the central body, thereby separating the tongue plate entirely and is fairly broad in front, while posteriorly it does not penetrate into the mentostipites.

Concerning the relations of Californiulidae to the other four families of Oncophora, the Paectophyllidae are to be considered as a decidedly secondary group with a large joint between the posterior gonopods and their supports and widely divided opisthomerite and mesomerite segments, therefore without any close relations, are outside of consideration. As to the Iulidae, however, which I have divided into eight subfamilies (p. 1647-1650), six of them possess flagella and only two—i.e., Pachyiulinae and Schizophyllinae—agree with Californiulidae in the lack of flagella in the anterior gonopods. Of these two subfamilies the Schizophyllinae are the more derived group, because they possess sperm foveae and generally also divided mesomerites or at least mesomerite processes. Thus the Pachyiulinae remain as that subfamily of the Iulidae, most closely approaching Californiulidae at least in regard to the primitive structure of the gonopods. But quite a number of the other above mentioned characters differentiate the Pachyiulinae considerably from the Californiulidae, so that a somewhat close relation cannot be conceived for any of the subfamilies of the Iulidae.

The Leucogeorgiidae are sufficiently characterized by the toothless labrum, the very weak toothpieces of the mandibles, and the occurrence of flagella. The nearest to *Californiulus* are certainly the Pteridoiulidae of the "Tauern" of which up to now only one genus is known. (Translator's Note: The Tauern are high mountain chains in the Tyrol, Austria.) Both genera not only agree in the lack of the mesomerite and flagella, but also in the slender build of both pairs of gonopods and that they are only partly sunk in pockets. A further agreement exists in that both genera possess a structure at the end of the anterior gonopods, a phenomenon rare among the Symphyognatha. Even in the division of the posterior gonopods into three sections a certain agreement cannot be mistaken, but it is incomplete, as in *Pteridoiulus* the three sections of the posterior gonopods are not brought about by muscles but by constrictions and difference in diameter, while in *Californiulus* this depends principally on the muscles.

However even these two genera cannot be united into one family, for *Pteridoiulus* has only four, while *Californiulus* has at least ten comb-like lamellae; in the first named genus the tip of the promentum does not reach the middle of the lamellae linguales, while in the last named the promentum extends to the central body. Quite a series of other differences can be seen from a comparison of these data with those in Zoolog. Anzeiger 1913, Vol. 43, No. 4, page 145, where I first described *Pteridoiulus*.

There is, therefore, ample justification to establish a separate family for *Californiulus*.

#### CALIFORNIULUS, n.g.

As this genus is the only one known of this family, the characters discussed above hold for it also. They may be supplemented by the following:

Pores of the defensive glands situated far back of sutures. Between the pronounced longitudinal grooves of the metazonite are numerous scattered gland pores. Telson without process. Ocelli numerous, in 7 rows. The collum appears especially characteristic when compared with that of the Iulidae, for example, *Pachyiulus*. The lateral lobes of the collum are not only much stronger bent downward and inward than in the former (Iulidae), but there are still other differences. While the sharpened anterior margin in *Pachyiulus* extends uniformly to the lateral angle, it stops in *Californiulus* a certain distance before reaching there. While the lateral lobe of the collum-phragma in *Pachyiulus* stops a good ways from the lateral angle, it continues without interruption as far as the lateral angle in *Californiulus*, so that the

margin of the phragma extends into the lateral margin of the collum without a break, which must be interpreted as a more primitive condition. Also the lateral lobes under the second body segment are strongly bent inward, slanting on the inner margin and broadly cut off. Pads occur on the legs of the male beginning with the third pair. Gnathochilarium as a whole almost forming a square. Outer and middle palpi only half protruding, hardly longer than broad.

*CALIFORNIULUS DORSOVITTATUS*, n. sp.

Male 94 mm. long with 74 body segments. Body black with broad yellow-brownish dorsal stripe and gray legs. The length of the second to sixth antennae segments which form slender cones differentiates this species from most of the Symphyognatha. The mouth parts (Figs. 4-6) were discussed above. A pronounced peculiarity is the fact that the exterior tooth structure of the mandible has three teeth, the inner ones have 5 to 6 teeth, the rasping plates are very finely cross striated and have short cilia without rasping ridges and without oblique grooves, therefore forming a simple arc in profile.

The lamellae of the combs are so dense that they are difficult to count; however I have been able to distinguish at least ten of them with certainty. There are 26 convex ocelli from above downward, 3, 4, 5, 5, 4, 3, 2. The sides of the collum already described have several grooves posteriorly. Sutures of the diplosomites strong and distinct throughout, pores of the defensive glands half as far from the suture as from the posterior margin, in front of them an ungrooved field, metazonites with widely separated grooves. Between two of the grooves usually two to three pairs of glands, besides fine punctuations. The striation of the prozonites is much finer and also more irregular. On the posterior half of the prozonites the fine lines run anteriorly at first but suddenly bend dorsally. On the anterior half the lines run transversely somewhat irregularly parallel. In the last quarter of the body, the metazonite grooves become much denser, the gland pores between them more numerous.

Pre-anal segment without dorso-posterior process, only protruding in an obtuse angle. Anal valves finely wrinkled, the inner margins are neither rigid nor depressed. Sub-anal plate simple.

The first pair of legs of the male (Fig. 9) is distinguished by low coxites and short but very broad prefemora. Femur and postfemur together form a semispherical sector and at the same time are not entirely delimited against each other on the inside,

which latter condition also holds good for the tibiotarsus, which projects as a strong hook, curving inwardly. The setae are longer and denser only at the outer base.

The second pair of legs of the male has no pads. Its rhombic very setaceous coxae while not grown together, meet along the median line throughout their length. I have been unable to detect any coxal glands. Back of these coxae there is a transverse oval depression in which the double penis is rooted (Fig. 8), which gradually narrows from the base to the end. It consists of two sections which I consider to be coxite and telopodite of a reduced pair of appendages. The longer coxites are completely grown together in the median line, while the shorter telopodites remain separate. The vasa deferentia open posteriorly in the region where the two sections meet (a Fig. 8).

The strong development of setae, the strongest I have ever observed on these organs must also be regarded as a primitive character, taken over from the primordial appendages.

The pads in the male begin with the third pair of legs, in such a manner that a stronger one occurs on the tibia, which with a triangular pointed process reaches almost to the middle of the tarsus and is very finely striated and a weaker very narrow one on the post femur, entirely without a process.

The two pairs of gonopods, which have already been discussed as to their phylogenetic-systematic relations, are distinguished not only by their length, but also by the fact that they are only partially set in, analogous to the Blaniulidae (it is impossible for me to determine their insertion more exactly, as I only have one male specimen).

The sternite of the anterior gonopods (v Fig. 10) projects in the middle as a blunt protuberance with small exterior lobes. Not a trace of either flagellae or Telopodites could be determined on the anterior gonopods. Particularly peculiar is the structure on the inner end (pr), projecting entirely to the rear. On the posterior surface of the anterior gonopods may be seen a ridge (k) starting from that structure and running more or less in the center towards the base, losing itself in the lower half. This ridge divides the rear of the anterior gonopods into two fields, a naked exterior one and an inner one, which is rather densely set with short setae and stops before an interior basal ridge. The terminal margin of the anterior gonopods is delicate and fairly dentate on the outside (e). The structure (Fig. 11) consists of three parts, a terminal club-shaped one without points, a median one, bulged at the base, projecting button-like and forming inside a leaf ser-



rated into points, and an inner basal one, resembling a partly closed hand, as toward the end it is divided into several oblong tooth-like structures. The posterior gonopods (Fig. 12) are situated on a transverse sternite which on the inside forms a transverse pad (k) and rounded off lobes on the outside. The posterior gonopods, which only touch each other basally for a very short distance are fitted to the pad of the sternite in so far as they have behind it a protuberance (h), which meets the former like a socket. The exterior of the posterior gonopods shows no distinct segments, but the unusual occurrence of muscles in these organs and moreover of two situated distinctly behind each other is an indication that they have arisen from the fusion of three segments. Mostly the basal muscles are placed crosswise (m—1, m—2) and occupy the basal third, while the terminal ones (m—3) are located in the middle third and run diagonally from the inside (base) to the outside (terminal). This middle third is characterized by a very strong tooth (Z—1) completely turned back on itself, alongside of its base on the interior margin there occurs a much smaller double tooth (Z—2). Back of it arises from the interior margin a hook-like posteriorly bent process (ac) which soon divides into two branches (Fig. 13), a short one divided into points and a longer flagella-like one, toothed on its base and also covered with fine points at its end. This pseudo-flagellum represents one of those numerous stimulators, of which the flagellae of the Iulidae are best known. On the terminal half of the posterior gonopods are scattered numerous setae. The gland canal (d)—well enough known in the Iulidae—runs through the basal and middle third and it is remarkable that its mouth is not on the anterior surface, but on the posterior one (for that reason not visible in Fig. 12) and is located on a small projection provided with a few setae. The location of the opening (x Fig. 12), however, can be precisely determined even in the front view, for it occurs where the basal ridge of the projection of the flagella ends, and where there is a fissure in front between the large tooth and the double tooth (z—2). Through this fissure (x) the gland secretion can reach the anterior surface of the posterior gonopods. The described muscles may influence the secretion of these glands.

Habitat: The only known male of this extremely interesting form I am also indebted for to Mr. A. E. Michelbacher, who collected it on Mt. Harkness in California..

On the Genus *PACHYDESMUS* Cook, Attems and *PACHYDESMUS*  
*CUMMINGSIENSIS*, n.sp.

C. Attems, who so far has investigated most of the Polydesmoidea forms of our globe and has contributed greatly to our knowledge of these diplopods, published in 1931 concerning "die



Familie Leptodesmidae u. andere Polydesmoidea" in number 79 of Zoologica, Volume 30, 3rd and 4th parts, pages 6-8, a very useful key for 38 genera of the Leptodesmidae. In this key, however, he has re-united with them the formerly separated family of the Fontariidae.

Under No. 17, "Prefemur of the legs with a cone (tooth) at the end", he cited the two genera *Pachydesmus* and *Rhysodesmus*, established by Cook. Meantime I have described two more genera, which are closely related to the two mentioned, viz., *Dampfaria* Verh. from Mexico and *Takakuwa* Verh. from Japan. The first mentioned one I already described in my 124th treatise on Diplopoda published in "Zoologische Jahrbuecher Jena" Vol. 62, numbers 5 and 6, pages 469-524, figures 48 to 50, Plate 6.

To clearly express the relationship between these four genera, I give the following key based on various characters:

- a. Prefemur of gonopods with a transversely placed branch (Fig. 14, prff).....*Pachydesmus* Cook, Attems
- b. Prefemur without such a branch.....c, d
- c. Only a small remnant of the tibiotarsus, a short spine, is left  
.....*Dampfaria* Verh.
- d. The tibiotarsus forms a long process split down to the prefemur, e, f
- e. The tibiotarsus is shorter than the solaeomerite, ends thinly  
flagella-like, the end of the femur has no distinguishing marks.  
.....*Rhysodesmus* Cook, Attems
- f. The tibiotarsus extends outward about as far as the solaeomerite,  
also retains its breadth to its bifurcated end, while on the end of  
the femur tooth and side lobes protrude.....*Takakuwaia* Verh.

Prefemur from 4th to last pair of legs of the male  
with spines well developed from 8th pair on.....

<i>Dampfaria</i>
<i>Rhysodesmus</i>
<i>Takakuwaia</i>

Prefemur with distinct spine only in posterior half of body, therefore missing on 8th pair of legs.....*Pachydesmus*

- a. Between the coxa of the fourth pair of legs of the male are two high sternal humps.....*Takakuwaia*
- b. Between the coxae of the fourth pair of legs of the male no, or only very low humps.....c, d
- c. The sides of the collum rounded off, the lateral margins of the scuta of the 17th to 19th body segments with broad rounded posterior lobes. Anal valves with longitudinal grooves but no hump alongside them on the outside, vertex of head shallow, frons without grooves.

X. Metazonite almost smooth.....*Dampfaria*

XX. Metazonite finely coriaceous.....*Rhysodesmus*

- d. Sides of collum triangularly pointed, on 17th to 19th body segments, the sides of the scuta triangular in rear and more or less pointed. Anal valves with deep longitudinal groove on inside, on outside alongside of them a hump, vertex of head and frons with deep longitudinal grooves.....*Pachydesmus*

My differentiation of the genera *Pachydesmus* and *Rhyssodesmus* thus shows quite a divergence from that given by Attems (loc. cit.) in his key of 1931. Principally his conception of the morphology of the gonopods is untenable. As I have stated my views in regard to this various times, I shall only mention briefly, that a tibiotarsus of the gonopods, as spoken of by Attems does not occur at all in *Pachydesmus*, unless the femoral process might be considered as such. The farthest projecting end of the gonopods, containing the sperm duct however is the solaenomerite beginning at the constriction, where the femoral setae cease.

PACHYDESMUS CUMMINGSIENSIS n.sp.

Male 41 mm. long; habits and color as frequently occurring in this group—i.e. brownish black and only the lateral margins of the acuta generally yellow to orange-yellow, legs of a lighter brown. Arrangement of pores normal.

Dorsum predominantly smooth anteriorly, more or less wrinkled posteriorly. Back of the sides of the collum a deep groove, sutures distinctly striated longitudinally. Metazonite without transverse grooves, pores in the marginal ridges of the lateral scuta all situated behind the median. Posterior corner of scuta rounded obtuse to right angled in the posterior half of the body with increasingly developed triangular points projecting posteriorly. Process of telson directed straight posteriorly.

The gonopods shown in Fig. 14 in whose coxites I have again followed the canals of the coxal glands (dr), show the coxal horn, indicated by stippling. Telopodite consists of a short prefemur, a longer femur and solaenomerite curved like a sabre. A transverse branch of the prefemur, which is about opposite the coxal horn (prff) bare and rounded off is out of the ordinary, while opposite to it an incomplete limitation is indicated between prefemur and femur by offset and constriction. The femur enlarged towards the inside, has here very long setae, and only very short setae on outside. A long horny process (pr) protrudes from the base of the femur, which might perhaps be considered as a tibiotarsus shoved towards the base. The natural branching of a tibiotarsus would have to occur at the end of the femur and alongside the base of the solaenomerite, that is at x, where as a matter of fact not a trace of a side branch is to be found.

*P. cummingsensis* is closely related to "*Fontaria*" *crassicutis* (Wood) from the region of the Mississippi; its gonopods have an interior branch at the prefemur, which is more slanting and more slender towards the end, while the femur is thicker and only has setae on the inside. The solenomerite lacks the obtuse angled bending. It is not certain if there are differences in the structure of the body segments.

Habitat: I have to thank Mr. Michelbacher for one pair of this species, which he collected near Cummings, California, May 6, 1935.

#### CYLINDROIULUS FRISIUS, OCEANICUS Verh.

In my 99th treatise on diplopods in "Natural History of Juan Fernandez" edited by Dr. Skottsberg, Vol. III, 1924, I first demonstrated the occurrence of this race of *Cylindroiulus frisius* Verh, which is otherwise widely distributed over Central and Middle Europe, from the island of Juan Fernandez. The gonopods are explained in Fig. 1 in the mentioned article. As I received the very same thing from California it seems to be a case of a race already widely distributed in the new world by transport through ships.

Male 10 mm., with 59 pairs of legs (5), female 11½ mm. with 65 pairs of legs (3). Habitat: Numerous specimens sent me by Mr. Michelbacher from California originated partly at Berkeley, partly at Santa Maria and partly at San Lucas.

#### EXPLANATION OF FIGURES

Figs. 1-3 *Californibolus* n.g. *micelbacheri* n.sp.

Fig. 1 Right anterior gonopod and its sternite (v) seen from in front; (cti) inner and (cte) outer part of coxite; (te) telopodite; m 1—m2 coxal muscles. (x56).

Fig. 2 Front view of posterior gonopod, only the proximal third of the support (s) was drawn; (g) joint between gonopod and support; (r) sperm canal; (ct) coxite; (pff) prefemorofemur; (tt) tibiotarsus. (x56).

Fig. 3 Posterior view of same. (x56).

Figs. 4-13 *Californiulus* n.g. *dorsovittatus* n. sp.

Fig. 4 Labrum and epipharynx seen from below. (x56).

Fig. 5 Outer and inner tooth piece of a mandible. (x125).

- Fig. 6 Promentum (pr); lamellae linguales (ll); and adjoining piece of the mentostipites (mst) seen from below. (x56).
- Fig. 7. Terminal segments of an antenna (5-7). (x56).
- Fig. 8 Penis from rear. (x125).
- Fig. 9. Front view of one first leg of male; (co) coxa; (prf) prefemur; (fe) femur; (psf) postfemur; (tt) tibiotarsus. (x56).
- Fig. 10 Anterior gonopod and its sternite; (v) rear view; (ar) pilose area (pr) terminal projection. (x56).
- Fig. 11 Terminal parts of anterior gonopod. (x125).
- Fig. 12 Rear view of posterior gonopod (v); (k) its sternite; (d) gland canal; (z1, z2) recurved spine; (ac) terminal process with flagellum; (m1, m3) muscles. (x56).
- Fig. 13 Flagellum process of preceding. (x125); to the right, flagellum (x220).
- Fig. 14 *Pachydesmus cummingsiensis* n.sp. Complete gonopod viewed from outside; (coa) coxal horn; (ml) its muscle; (dr) canal of coxal gland; (r) sperm duct; (prff) process of the prefemur; (fe) femur; (pr) femur process; (sl) solaenomerite; (x) border between solaenomerite and femur; (lo) outer coxal lobe. (x56).



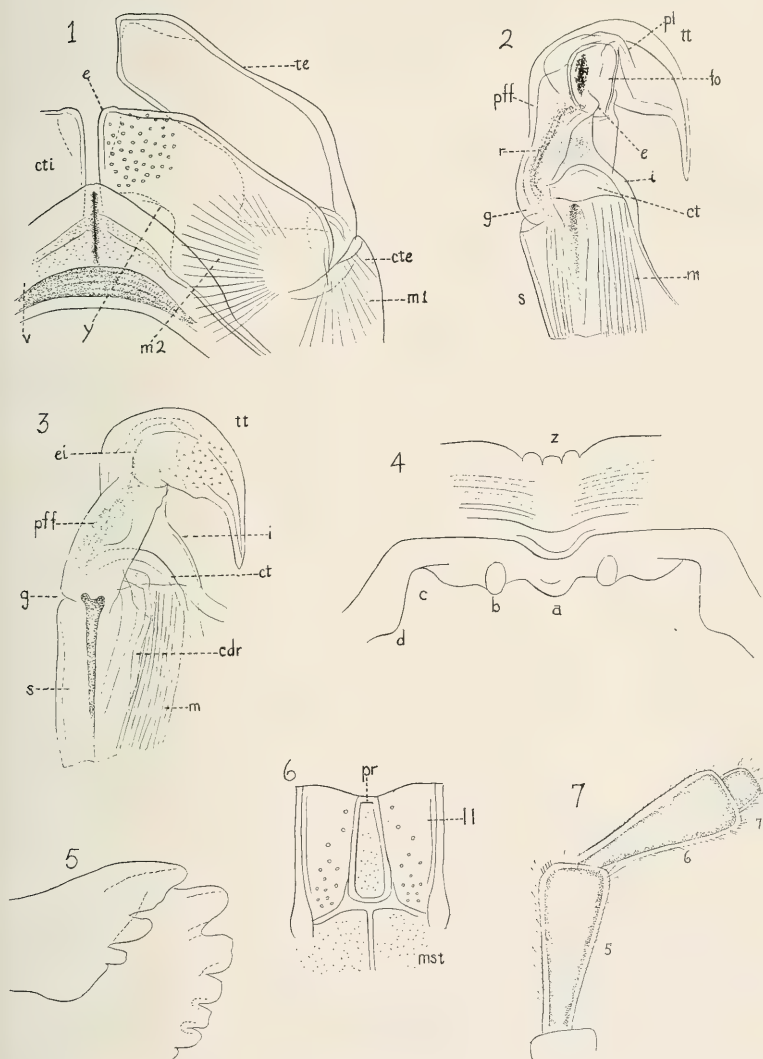


PLATE 12



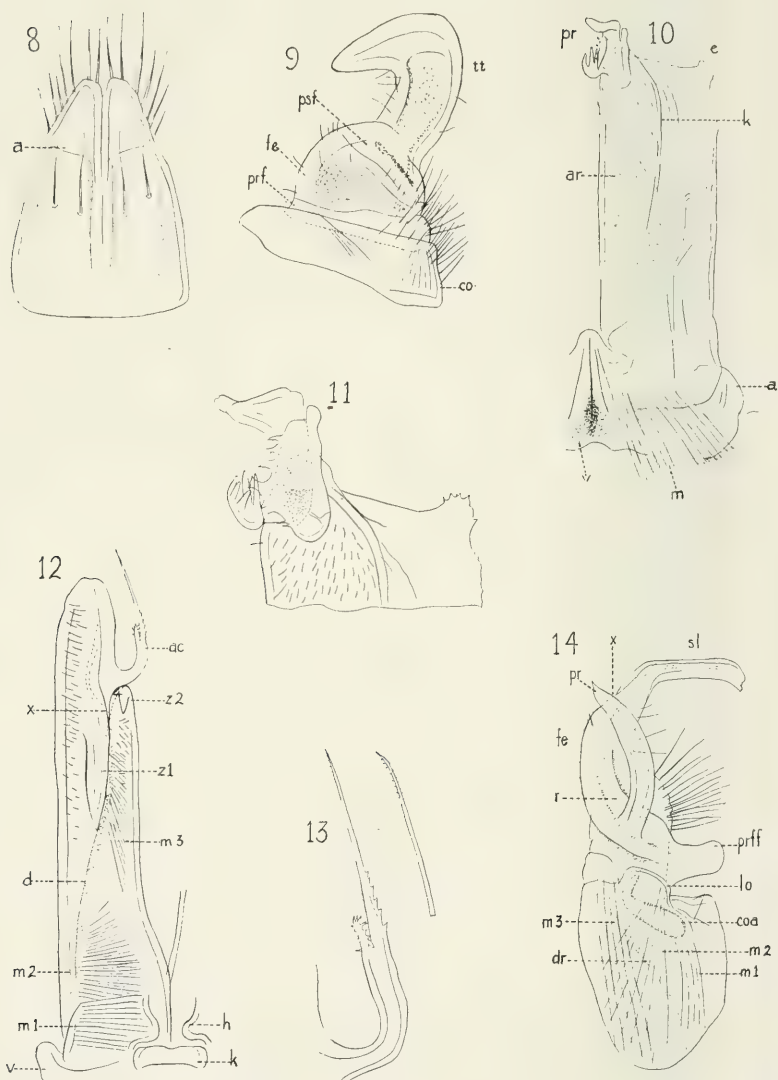


PLATE 13

NEW SPECIES OF MOLLUSKS FROM REDONDO,  
CALIFORNIA

By G. WILLETT

Los Angeles County Museum

Among the many interesting mollusks dredged by John Q. and Tom Burch off Redondo Beach, California, the following appear to be new to science, and are here described.

*Nuculana burchi* sp. nov. (Plate 14, fig. 3). Description.—Shell brownish or olivaceous, trigonal, oblong, rather flat; rounded anteriorly, bluntly pointed posteriorly; posterior dorsal margin slightly curved; beaks subcentral, not prominent. Exterior sculpture of flattened ribs with narrower interspaces; sculpture less arcuate than growth lines. Anterior teeth 20-22, posterior teeth about 15. Resilium triangular, short, slightly projecting.

Type, right and left valves, No. 1066 Los Angeles County Museum. Type and 10 additional valves collected by John Q. and Tom Burch, in 50 fathoms, off Redondo, California. Two additional valves taken 5 miles off El Segundo, California. The type right valve measures: long. 12.2, alt. 7.7, lat. 2.4 mm. The largest valve in the type lot (Burch coll.) measures 14x8.7x2.5 mm.

This shell is very similar to *N. cellulita* Dall, but differs from that species in flatter ribs and narrower interspaces, producing a smoother surface; and shorter and more projecting resilium. It is also proportionately more slender than *cellulita*, and no specimens seen are as large as adults of that species. *Burchi* differs from *N. taphria* Dall in being flatter, with blunter posterior end, straighter posterior dorsal margin, and very much finer ribbing.

*Volvulella tenuissima* sp. nov. (Pl. 14, fig. 1). Shell imperforate, cylindrical, very slender; aperture narrow, as long as the shell; rounded in front; spine short. Color grayish-white, with brown stain from spine down inner side of aperture to and including the columella. Axial sculpture of growth lines curved towards the extremities; spiral sculpture of exceedingly fine, wavy striations that cover the entire surface of the shell, but are visible only with the aid of a fairly strong lens.

This shell is nearest to *V. cylindrica* Carpenter, but is smaller, much more slender, and lacks the distant spiral striae characteristic of that species.

The type, No. 1073 Los Angeles County Museum, and numerous additional specimens were collected by John Q. and Tom Burch off Redondo, California, in 75 fathoms. Paratypes are in

the U. S. National Museum, California Academy of Sciences, and in the Burchi and Willett collections.

The type (not quite adult) measures: Long. 4.3, lat. 1.6 mm. The largest specimen at hand measures 6x2.1 mm.

*Philine californica*, sp. nov. (Pl. 14, fig. 4). Shell of two or more whorls, oval, inflated, slightly contracted below the apex; spire sunken, concealed, only the extreme tip being visible. Aperture very large, oval, contracted above; outer lip extended slightly above the apex and curved down to join the body-whorl; inner lip thin, twisted, and flattened where it joins the body-whorl in front of a minute umbilical groove. Sculpture of fine, close, rather regularly-spaced axial striae, crossed by fine, irregularly-spaced spiral striae, forming a latticed sculpture; on the upper part of the shell there are minute tubercles at the intersections of the striae. Color dull white, with a broad, light-brown band slightly above the middle.

A rather poor photograph of the living specimen shows that the animal is much too large to be contained in the shell, the head, disk, foot and mantle being outside.

The unique type, No. 1074 Los Angeles County Museum, was collected by John Q. and Tom Burch off Redondo, California, in 50 fathoms. The type measures: alt. 5.5, lat. 3.6 mm. (lip not entire).

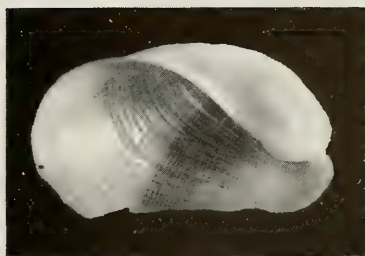
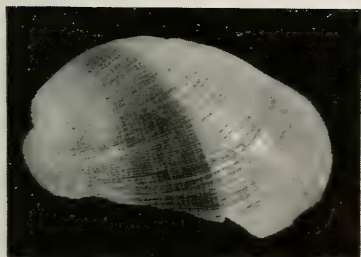
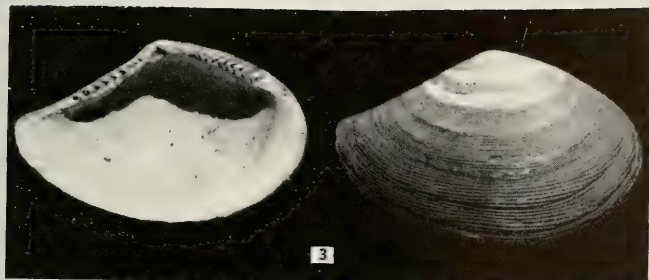
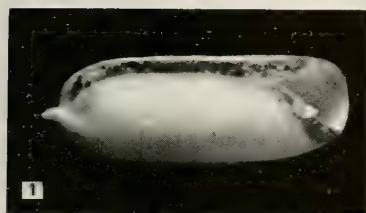
The latticed sculpture of this little shell would place it in the Section *Laona* A. Adams, not previously reported from the Pacific coast of America.

*Melanella rosa* sp. nov. (Pl. 14, fig. 2). Shell imperforate, slender, straight except for an almost imperceptible inclination of the first four whorls to the right. Whorls 12, increasing in diameter very slowly; the last whorl proportionately very high and unusually straight along the sides. Sutures appressed, obscure. Aperture narrow and high, very acutely angled above. Outer lip normal; inner lip reflected over and appressed to the base and continuing to join the outer lip. Color bluish-white, except where the brownish animal shows through.

The unique type, No. 1075 Los Angeles County Museum, was dredged by John Q. and Tom Burch in 125 fathoms, off Redondo, California. It measures: Long. 11, lat. 2.5 mm.

In shape this species is similar to some of the more slender specimens of *M. rutila* Carpenter, but it is very much larger than that shell. It differs from *M. micans* Carpenter in more slender shape (nearer parallel sides), and proportionately much higher aperture and last whorl.

This species is named for Mrs. Rose Burch, wife of the senior collector and mother of the junior.



## PLATE 14

1. *Volvuteella tenuissima* Willett, type, X 10.
2. *Melanella rosa* Willett, type, X 4.
3. *Nuculana burchi* Willett, type, X  $3\frac{1}{2}$ .
4. *Philine californica* Willett, type, X  $7\frac{1}{2}$ .

MISCELLANEOUS AVIAN FOSSIL RECORDS  
FROM CALIFORNIA

By HILDEGARDE HOWARD

In the past ten years a number of fragmentary bones of fossil birds have come to my notice. Since, for the most part, they are isolated specimens incapable of definite specific identification, no published records were made. With several such occurrences now at hand, however, it seems desirable to report upon them, particularly as they add to the known localities from which avian fossils have been obtained. All are from fossil deposits in southern California.

## SANTA ROSA ISLAND, Pleistocene

In the California Institute of Technology's excavations for Exiled Elephant in Pleistocene deposits on Santa Rosa Island, eight bones of ducks and geese were included in the material removed. These were made available to me for study through the courtesy of Dr. Chester Stock. All were mineralized, and of a mottled grayish color. The goose bones (five specimens) are assignable to *Branta canadensis*, with variations in size suggesting the possible inclusion of three races, *Branta c. canadensis*, *Branta c. leucopareia*, and *Branta c. minima*. A complete humerus is indistinguishable from bones of Green-winged Teal (*Anas carolinensis*), and an incomplete coracoid resembles that element in Mallard or Pintail Duck (*Anas*, sp.)

## BIXBY SLOUGH, HERMOSA BEACH, Pleistocene

A single femur of bird was collected by George Kanakoff, of the Los Angeles County Museum, in a marine deposit near Bixby Slough. The associated molluscan fauna was typical of the Palos Verdes formation, of upper Pleistocene age, and indicated shallow water, estuarine conditions.

The bone is in good condition, petrified, and of a brownish color. In all of its contours it agrees with bones of the Pleistocene Diving Goose, *Chendytes lawi*. It seems, however, to have come from a slightly smaller bird than that represented by the type tibiotarsus from Santa Monica. I have previously observed considerable difference in size in studying the bones of *Chendytes* accumulated from various localities, but believe the variation to be within the possible range of a single species.



## NOB HILL, SAN PEDRO, Pleistocene

In the collections in the Los Angeles County Museum taken from Pleistocene marine deposits at 2nd and Orizaba streets (Nob Hill) in San Pedro, are two bones of birds, one from the Palos Verdes formation, the other from lower strata, San Pedro formation. The former specimen is a rather worn distal end of a tarsometatarsus of a quail. As *Lophortyx californica* has been recorded from another Palos Verdes formation deposit ("Lumber Yard" locality in San Pedro), it is likely that this is the species here represented, though the worn condition of the bone prevents a definite assignment.

The specimen from the lower beds is a distal fragment of humerus of a murrelet, possibly *Synthliboramphus antiquus*, as reported from the "lumber yard" locality, but agreeing as well with bones of birds of the genus *Brachyramphus*.

## LOMITA SAND PIT, Pleistocene

A shaft of humerus of a large loon was found by one of the workers of the Sidebotham Sand Co. in that company's sand quarry at Lomita. This locality is now considered to belong to the San Pedro formation, of Lower Pleistocene age. The specimen is well mineralized and of a red-brown color. It agrees closely in size and contours with available modern specimens of *Gavia immer* and likely represents that species. In view of the absence of the ends of the bone, however, the assignment is made tentatively.

## POINT FERMIN, Miocene

An unusual specimen was presented to the Museum by Miss Gladys Peyser, with the following annotation: " 'Float' specimen, collected by Pfc. Mort D. Turner, at foot of cliff, Point Fermin, California." The specimen is a water-worn "pebble," which Dr. M. Bramlette, of the U. S. Geologic Survey, has kindly analyzed for me as being a silty impure limestone bearing imperfect tests of foraminifera, probably of the Monterey formation, and either upper or middle Miocene in age. It is about 3 inches in diameter and bears the incomplete imprint of a bird's foot, with portions of the bone still adhering. (See Plate 15.)

The distal end of the tarsometatarsus and two phalanges of each of three digits are represented. Apparently the specimen is of a right foot, showing the impression of the outer surface of the first and second trochleae and a small portion of the lower end of the shaft of the tarsometatarsus. The third (outer) trochlea is probably in the matrix beneath the imprint of the middle one.

The tarsometatarsus is about the size of that of a Glaucous-winged Gull or a Wood Rail, and the relative height of the first trochlea agrees with both gull and rail. The contours, however, are closer to the rails and coots than to the gulls, the middle trochlea, particularly, being shorter and more rounded. The shape of the upper end of the first phalanx of what appears to be digit 2, as revealed by reversal of lighting in the photograph, is also suggestive of the Rallidae, as is the slenderness of the phalanges.

In proportions of the toes, however, the fossil does not agree with any modern bird compared. Phalanx 1 of what appears to be digit 3 (lying directly below the middle trochlea of the tarsometatarsus) is short and is exceeded in length by the first phalanx of the other two toes present, as well as by the second phalanx of its own digit.

The fossil certainly cannot be given generic or specific designation. It is tentatively referred to the Rallidae.

#### SUMMARY

Fragmentary avian records are reported from the following fossil localities in southern California:

Santa Rosa Island, Pleistocene

*Branta canadensis*

*Anas carolinensis*

*Anas* sp.

Bixby Slough, Hermosa Beach, Pleistocene

*Chendytes lawi*

Nob Hill, San Pedro, Pleistocene

Quail, species (Palos Verdes formation)

Murrelet, species (San Pedro formation)

Lomita Sand Pit, Pleistocene

*Gavia immer?*

Point Fermin, Miocene

Rallidae?, species

Los Angeles County Museum, August 14, 1944.



PLATE 15

Water-worn "pebble" with imprint of incomplete foot of a Miocene bird (*Rallidae?* species). Found in "float" at Point Fermin. Specimen lighted to produce effect of bones being raised. Natural size.

## ENTOMOPHOBIA

By W. DWIGHT PIERCE

There has probably always been more or less fear of insects and spiders among people who do not understand them, but it seems to me that there is quite an increase in a peculiar type of insect fear, which we have been calling our psychological cases.

These people have the notion that something is crawling on them and biting them, and they besiege the doctors, health officers, pest control operators, and Museum entomologists for relief.

They claim to see insects crawling on their bodies, or their bedding, but the things they bring in as evidence of what they have seen are only rolled up hairs, skin scurf, dandruff, scabs, plant debris, and particles of sand, etc. In not one of these cases has there been any evidence of mites, bugs, fleas, lice or other body pests.

They often have tiny pimples, which in no wise resemble insect bites; sometimes nerve end lesions, ingrowing hairs, etc.

Brief descriptions of some of these cases may be of interest.

Case 1: A woman of beyond middle age said her son-in-law had taken some bedding on a camping trip the year before, and brought back mites on the blankets. These mites had greatly distressed the family for many months. The house had been fumigated several times. On my recommendation the pest control operators, after thoroughly inspecting the bath room, asked her to bathe and put on clothes fresh from the laundry, and go straight out of the house and to a hotel, while they refumigated the house. In a few days she was complaining again and demanding a refumigation. No mites were found either before or after the fumigation. She brought her expensive blankets and sheets straight from her bed and asked me to examine them, because she said there were many of the creatures on the bedding. There was nothing on this bedding but ordinary body exuviae, skin scurf, and hairs, but she pointed them out as insects. Many of the little creatures she pointed out in the blankets proved to be microscopic portions of the cotton boll, not removed in the ginning, spinning and weaving of the blankets. Even when shown her evidences under the microscope, she was not convinced. A few

days later she announced that she had destroyed the blankets; and she brought her fur coat to prove that the mites were in it. There was a *Dermestes* cast skin.

A year later the same woman came in with the identical trouble. She said her husband, and other members of the family were now feeling the crawling on themselves. Just then she said: "There's one now on my eyelashes. I can see it crawling." With a head-piece binocular I examined her eyelashes, and saw a tiny bit of dandruff on the lash she indicated. This woman went to many people, but refused to believe that any of us were correct in telling her that she was letting her imagination go wild.

Case 2. An old couple in the hair business, foreigners, came in announcing in unison at their first breath: "All of our customers have lice, but they get angry with us when we tell them so." When I remarked that this was very unusual, because very few people have lice, they ejaculated: "But they have; we are not crazy." "What kind of customers do you have?" "The very best people in town. We only deal with high class people." "Then you are wrong about their having lice. Of course you insulted them, when you told them so." "We are not crazy. They have lice. They sit down in front of us, and almost immediately scratch themselves. And immediately the things jump over, and are on us, and we scratch ourselves." "Oh, they probably have prickly heat, and your sensations are due to mental suggestion. It is quite natural for a person to scratch himself if he sees somebody else do it." "We are not crazy." "I didn't say you are, but you are letting your imagination get control of you. You must control yourselves." And they went away saying, "We are not crazy."

Case 3. A boy of 15 who suffers from asthma, heard the High School teacher tell how disgraceful it is to have lice on one self. Their school had never had a case. He went home, very uncomfortable, and told his mother he had lice, and was a disgrace to his school. She wrapped his head in kerosene-soaked towels every night, and made him take daily baths and a complete daily change of clothes. But still he complained of lice on his head and body. They used a fine tooth comb, which I later saw, and it contained nothing but dead skin. The older brother in the Army, on three separate occasions was not permitted to come home, for fear of contamination. The mother and father were commencing to feel itchy, and to complain of feeling fine silken hairs on their faces. A pest control operator was called, and after examination refused to fumigate. The mother sent me samples of the so-called insects from the boy's head, body and bed. They were the usual skin and hair debris. Finally the boy came to see me. His head and body were as clean as could be, but he had a



few ingrowing hairs on his head, and body. He showed a general fear of all insects and spiders, and so was shown some of our insect beauties, and told about the girls who helped in the laboratory experiments with black widow spiders and tarantulas. He seemed to understand that his imagination was working over time. But a few days later the mother phoned again that they were all bothered with feeling silken threads on their faces when they went outdoors. I explained that they were probably the silken threads sent out by baby spiders.

Case 4. A young woman complaining of mites on her body, had been daily soaking her body in cleaning fluid, and then rolling up all the skin debris in vaseline. She brought this to prove that she had mites or insects on her body. It was the same kind of material that all the others had brought, and in no case was there a single fragment of any living creature. She had been to doctors, but did not believe them when told her skin was perfectly healthy. I know I did not convince her either. This woman had a nervous breakdown two years ago, and was regularly taking B vitamins. She was heading for another breakdown.

Case 5. A young beauty parlor operator complained of mites and said that she would lose her job if she could not get rid of them because the proprietor said that her scratching was affecting all of the customers. After examining her evidences and scabs from her body, I assured her that there were no mites, and that the pimples were from some internal source; and that her nerves were overworking. Suddenly I threw my hand up and scratched myself. She said, "Is that all there is to it?" I said, "Yes. I can make anyone scratch by talking about lice or mites." She went away determined to get control of herself.

These are samples. There have been many more.

I am wondering if there are allergies to cosmetics, or rayon, or something else in some of these cases.

Having read this little article, did you experience any tingling or itching while you were reading it? If so please write and tell me your experience.

## FOUR CALIFORNIA MOTHS ASSOCIATED WITH CAT-TAILS

By JOHN A. COMSTOCK

In an examination of *Typha* (cat-tails) in southern California the lepidopterist is likely to find the larvae of four species of Phalaenid moths. The species most commonly encountered is *Simyra henrici* Grt. The larva of this moth feeds externally on the leaves, and its depredations are not confined to cat-tails. The life history was recorded and illustrated in the "Bulletin, Southern California Academy of Sciences" for 1934, Part 3, pp. 143-145. The imago is here shown on Plate 16, fig. A.

The other three species are borers in the *Typha* stalks and may only be observed by cutting the plant close to the roots and peeling off the leaves.

The rarest of these is *Archanara alameda* Smith. The species was first described from eight examples taken by A. Koebele in Alameda County, California,<sup>1</sup> and the moth is figured by Hampson<sup>2</sup> on Plate CXLIII, fig. 30. So far as we can determine the original type specimens are all that are known.

The writer recently collected a single example at light in Del Mar, San Diego County. In the cursory collecting of larvae in cat-tails along water courses in Los Angeles County no examples of *alameda* were reared. Areas close to the coast have not been examined and it is not unlikely that this rarity will be turned up at various coastal points between the San Francisco Bay region and San Diego County.

Nothing is known of the early stages, but it is more than likely a *Typha* feeder. The moth is illustrated on Plate 16, fig. B.

The common species of the group is *Archanara oblonga* Grt. This was first described in 1882<sup>3</sup> from an example taken by Thaxter at Kittery Point, Maine, in spite of which fact Holland<sup>4</sup> lists it as occurring only in Florida. Hampson, previously cited, lists Maine, New York, Florida, and Jamaica. Dr. Smith<sup>5</sup> was the first to point out that it also occurs in Arizona and California. A colored figure of the moth is shown on Plate XXV, fig. 30 of Hollands "Moth Book." We illustrate it on Plate 16, fig. C.

Kellicott first recorded the life history in 1885<sup>6</sup> and pictured the pupa. Walton, in 1908<sup>7</sup> gave a very full account of the habits

and life history, with excellent illustrations of the moth, larva, pupa, and two parasites. As the publication in which this appeared is available to most students it seems unnecessary to illustrate it here.

The larva of oblonga in its later stages feeds within the center of the *Typha* stalk, but is usually found at a higher level than that of *Arzama gargantua* Dyar, the latter being the fourth species under consideration. The last two mentioned species cause a depletion of the plant's vitality which results in a yellowing of the innermost leaves. This makes it possible to locate infested plants at a glance.

*Arzama gargantua* was described by Dr. Dyar in 1913<sup>8</sup> from three females taken in Los Angeles by Coquillett, reared from *Typha latifolia*. The moth apparently does not come to light, and is rare in collections, but it is easily reared from cat-tails. Mr. Lloyd Martin, Arthur H. Forsman, and the writer secured 147 pupae on June 28th of this year from cat-tails taken in the upper Los Angeles River wash near Burbank. These were removed from the plants, and each one was placed in a small glass vial in the bottom of which had been poured about one-half inch of water, with a small pledget of cotton and a plug of cat-tail pith above it. This pith separated the pupa from the cotton and water, which safeguarded the cremasteric spines against entangling in the cotton, and at the same time assured adequate moisture. With the use of this technique it is possible to obtain practically 100% emergence, since it simulates conditions in nature that are favorable to hatching. If the pupae are left in the plant they are liable to injury, either as a result of the drying and shrinking of the stalk, or from growth of moulds.

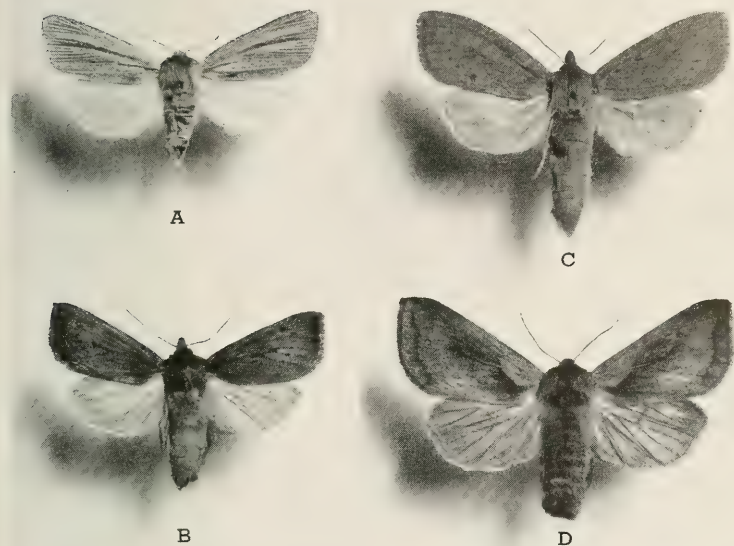
No parasites were recovered. The pupae emerged in the period between June 29 and July 28.

The range of the species has not been determined, but it is apparently limited to the coastal plain of the Los Angeles-Orange County area.

The imago is pictured on Plate 16, fig. D. Elsewhere in this issue of the "Bulletin" will be found a description and illustration of the larva and pupa.

#### BIBLIOGRAPHY

1. Smith, J. B., Proc. Ent. Soc. Wash. 5:318. 1903.
2. Hampson, Sir George F., Catal. Phalaenae Brit. Mus. IX: 299, 1910.
3. Grote, A. R., Papilio. 2 (6): 96. 1882.
4. Holland, W. J., "The Moth Book." 211. 1908.
5. Smith, J. B., Proc. Ent. Soc. Wash. 5: 314. 1903.
6. Kellicott, D. S., Bull. Buffalo Soc. Nat. Sci. 5: 40. 1885. (as subcarnea).
7. Walton, W. R., Ent. News. 19(7): 295-299. 1908.
8. Dyar, Harrison G., Ins. Insc. Mens. 1(1): 19. 1913.



## PLATE 16

- A. *Simyra henrici* Grt. ♂ Los Angeles Co., Cal., March 12, 1936.
- B. *Archanara alameda* Smith. ♀ Del Mar, San Diego Co., Cal., May 30, 1943. At light.
- C. *Archanara oblonga* Grt. ♀ Hancock Park, Los Angeles. Emerged July 16, 1944. Pupa in *Typha latifolia*. Coll. Lloyd Martin.
- D. *Arzama gargantua* Dyar. ♀ Los Angeles River. Emg'd. July 9, 1944. Pupa in *Typha latifolia*. Coll. L. Martin.

Figures natural size. Photo courtesy L. A. Co. Museum.

THE LARVA AND PUPA OF ARZAMA  
GARGANTUA Dyar

By JOHN A. COMSTOCK and CHARLES M. DAMMERS

Mr. T. W. Hower collected a single larva of *Arzama gargantua* Dyar in Orange County, California, on April 15, 1936. This was raised to maturity by the junior author, and preliminary notes were made at that time. The senior author was later able to examine more than a hundred specimens of mature larvae and pupae and thus confirm, and in some details amplify the prior observations.

The egg and first few larval instars have not been recorded.

The mature larva bores into the heart of the central pith of *Typha* (cat-tail), the burrow usually extending into the base of the root.

The pupa is formed in the lowest portion of this burrow, but works its way up to a previously prepared opening just before emergence.

The cat-tails that harbor the larvae are not able to produce flower spikes, and the central leaves become yellow.

The larva matures in late June and July, and the pupal life is of short duration.

MATURE LARVA. Average length, 45 mm. Cylindrical, smooth and shiny, flattening out considerably along the infrastigmatal fold.

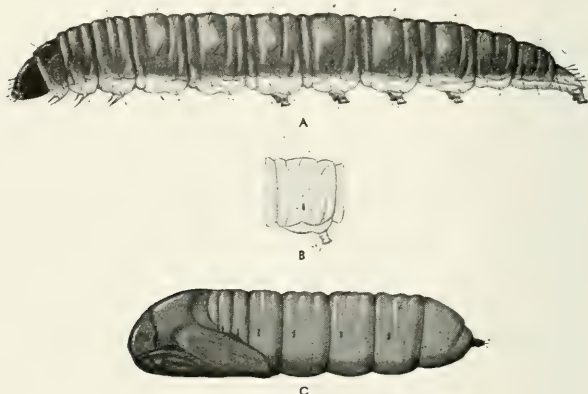


PLATE 17

Mature larva and pupa of *Arzama gargantua* Dyar.

A. Larva, side view. B. typical segment of larva, showing position of setae. C. Pupa, lateral aspect. Figures enlarged X 1 2/3.

Reproduced from painting by C. M. Dammers.



The body above this fold is dark olive and the ventral surface is pale olive-white. The cervical shield on the first segment is a very dark olive. Legs, dark olive, with soiled white bands. Prolegs, solid white, with dark olive crochets. The last caudal segment is small and much flattened. Spiracles, dark olive, with black rims.

Twelve short dark setae occur on each typical segment.

Head: very dark olive, with a soiled white inverted  $\Delta$  on the front and a soiled white bar above the mouth. Ocelli, dark olive. The larva is illustrated on Plate 17, fig. A.

PUPA. Average length, 29 mm. The body is regularly cylindrical throughout, except for the abruptly tapering cauda and the front portion of thorax. Color, uniform bright chocolate, with the head, thorax and wing cases slightly darker. The wing cases extend about two-fifths the distance toward cauda, and the antennal sheaths do not reach to their margins. The body surface is very finely granular or

punctate, except for an area immediately anterior to the movable segmental junctures. There are four such junctures, and in front of each one is a smooth surface extending about one-third of the area of the segment; at this point there is a line of very small spines running transversely around the segment. These spines are best developed laterally and, they, together with the cremasteric spikes, doubtless assist the pupa to move upward in the burrow prior to pupation.

There are two small nodular protrusions near the head, each of which arises close to the root of an antenna.

The cremaster is irregularly quadrate, and very rugose, and four stout spikes occur on its distal edge.

Spiracles, dark chocolate.

No setae are present on any portion of the body.

Anterior to the cremaster, in the mid-ventral line is an indentation which is valve-like in appearance.

The pupa is illustrated on Plate 17, fig. C, and also on Plate 18.

The imago is pictured on Plate 16, fig. D.

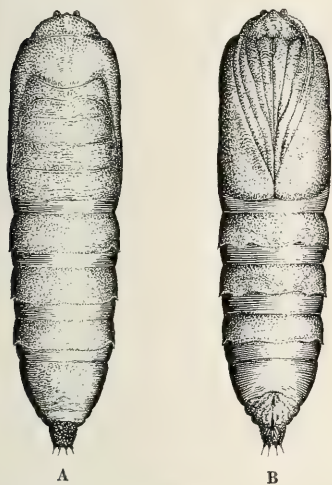


PLATE 18

Pupa of *Arzama gargantua*. A. Dorsal aspect. B. Ventral aspect. Enlarged X 2.

Drawing by John A. Comstock

## NOTES ON THE FOOD OF REPTILES WITH SPECIAL REFERENCE TO THEIR POSSIBLE CONTROL OF CONE-NOSED BUGS

By SHERWIN F. WOOD

1015 North Alexandria Avenue, Hollywood 27, California

### INTRODUCTION

The writer has recently recorded (Wood, 1944) the reptiles found inside wood rat (*Neotoma* spp.) houses following surveys (Wood and Wood, 1938; Wood, 1942, 1943) of these dens for cone-nosed vectors (*Triatoma* spp.) of Chagas' disease in southwestern United States.

Lizards are known to eat many kinds of insects and experimental tests reported here show that they will feed upon *Triatoma*. Some of the stomachs of the lizards collected from wood rat houses have been examined for the presence of cone-nosed bugs and the results recorded below.

### OBSERVATIONS

Western Gecko, *Coleonyx variegatus*. On May 18, 1942, twenty small *Triatoma longipes* nymphs were placed in a jar with 5 adult lizards. Two bugs were eaten immediately by 1 gecko and another chewed 2 but spit them out. Twelve of the remaining nymphs were eaten within the next 24 hours. On May 20, 1942, a very warm day, 10 small nymphs of *T. longipes* were placed in a glass cage with 2 adult lizards. Twenty-four hours later the lizards had eaten 9 nymphs and the flattened remains of a tenth nymph in the cage indicated that it had been chewed. On May 24, 1942, a cool day, 3 medium nymphs of *T. protracta* were placed in a covered jar with 1 adult *Coleonyx*. Twenty-four hours later these bugs had been eaten. On May 25, 1942, three medium nymphs of *T. rubida* were placed in a jar with 1 adult gecko which ate all the bugs within the next 24 hours.

The stomachs of 3 adult *Coleonyx* collected from *Neotoma albigula albigula* houses on June 1, 1940, at the Alvarado Mine, near Congress Junction, Yavapai, Co., Arizona, revealed the fol-

lowing: no. 1, remains of 1 small beetle and 1 grasshopper; no. 2, the bulk consisted of 2 crickets, the largest being 12 mm. long as compacted in the stomach, and insect remnants; and no. 3, a small amount of unidentifiable insect remains. Three other adult lizards collected December 21, 1940, in the same habitat at the above location showed the following: no. 1, approximately one-half the contents consisted of termites (40 individuals), the remainder contained 2 spiders, 5 beetles, and insect remnants; no. 2, the bulk consisted of 1 solpugid or sun spider, measuring 18 mm. as compacted in the stomach, with insect remnants constituting the remainder; and no. 3, most of the total content was 2 moths, each approximately 22 mm. long, with 1 small spider, 1 disintegrated beetle, 1 nematode worm, and insect remnants constituting the remainder.

Some idea of the yearly consumption of insect food by this lizard may be obtained from the following notes: An adult received August 8, 1934 from L. M. Klauber was kept alive in a small glass terrarium on the sunny side of the room near a south-facing window in the Life Sciences Building, Berkeley, California until August 25, 1935. During this time the writer saw this gecko swallow 24 large (23 to 31 mm. plus), 87 medium (19 to 23 mm.) and 52 small (up to 19 mm.) yellow meal worms, larvae of the beetle, *Tenebrio molitor*. This was the only food supply. The largest number eaten at any one time of any size was six. The longest period between feedings was 26 days and the shortest was one day. After the larvae were dropped on the sand near the lizard, it would slowly stalk the actively moving meal worms grabbing them with a quick lunge, generally swallowing them head first after maneuvering the body of the worm about in its mouth. Sometimes after eating several, it seemed difficult for the lizard to swallow the next one. This process was facilitated by sharp bending of the whole fore-part of the body, often into almost a perfect S. During these contortions of the body the gecko would close its eyes. It seemed to eat either day or night but often refused to eat at all.

This gecko was most active at night and retreated during the daylight to a cardboard mailing tube 2 inches in diameter and open at one end. At first it preferred to burrow under the carton, then later spent most of its time inside the cardboard tube. It would dig extensively in the sand as noted by Derbonne (1934) especially in corners of the terrarium.

A water container was not put into the terrarium until January 24, 1935, but the lizard drank 3 times before this date from a medicine dropper. Water seems to be necessary for survival of the lizard on a diet of meal worms. Several times the gecko

refused to eat and seemed very sluggish until after water was offered. It would drink greedily, lapping up the drops either directly from the dropper or from the glass wall of the terrarium. When a dish of water was kept in the cage, the lizard would lap up the liquid for several minutes at a time. Several times the gecko fed shortly after drinking although it had refused food before taking the water.

Another adult, kept alive from April 5 to July 14, 1934, consumed 31 large, 13 medium, and 3 small meal worms. This lizard was in good condition when preserved. From April 5 to July 19, 1934, a half-grown gecko ate 6 medium and 30 small meal worms but died on July 19.

Desert Crested Lizard, *Dipsosaurus dorsalis dorsalis*. On May 20, 1942, ten small flat nymphs of *Triatoma longipes* were placed in a jar with 1 immature crested lizard. Six of these bugs were eaten by the lizard over a 24-hour period. This same lizard in the next 24 hours ate 1 small nymph of *T. rubida*. On May 24, 1942, five medium sized nymphs of *T. protracta* were placed in the jar. The lizard ate 1 immediately and 3 others in the next 24 hours.

Western Collared Lizard, *Crotaphytus collaris baileyi*. Five small nymphs of *Triatoma longipes* and 5 medium nymphs of *T. protracta* were not eaten by 1 adult lizard over a 24-hour period on May 20 and 24, respectively, 1942.

Desert Side-blotch Lizard, *Uta stansburiana stejnegeri*. On May 20, 1942, a very warm day, 5 small flat nymphs of *Triatoma longipes* were placed in a covered jar with 1 adult *Uta*. Twenty-four hours later, 1 nymph had been eaten by the lizard.

Arizona Fence Lizard, *Sceloporus consobrinus*. The stomach of 1 specimen collected July 26, 1936, seven miles southwest of Santa Fe, Santa Fe Co., New Mexico, contained 1 beetle (Coccinellidae) and 2 round worms (Nematoda).

Striped Fence Lizard, *Sceloporus elongatus*. The stomachs of 2 specimens collected August 5, 1936, twenty miles north of Flagstaff, Coconino Co., Arizona, contained the following: no. 1, 8 beetles including 1 weevil (Curculionidae), and 1 small grasshopper, and no. 2, the remains of 3 beetles, heads of 8 red ants, and other insect remnants.

Western Fence Lizard, *Sceloporus occidentalis biseriatus*. On May 25, 1942, three medium nymphs of *Triatoma rubida* were eaten by 1 adult ♂ as soon as they were dropped into the



jar. The stomach of 1 adult collected August 28, 1937, near Eaton Canyon Dam, Pasadena, Los Angeles Co., California, contained 9 beetles (6 Coccinellidae, 2 Buprestidae, 1 Cerambycidae) plus a small amount of insect remnants.

Desert Scaly Lizard, *Sceioporus magister magister*. On May 20, 1942, one adult ♂ ate 12 (of 20 offered) small nymphs of *Triatoma longipes*; on May 21 the same lizard ate 2 small nymphs of *T. rubida*; and on May 24, four medium nymphs of *T. protracta*, each feeding covering a 24-hour period of exposure. On May 25, 1942, the writer saw this lizard eat 3 medium nymphs of *T. rubida* as soon as they were placed in the jar. On July 3, 1942, this adult ate 2 ♂ and 1 ♀ *T. rubida* immediately, then refused others offered but ate 1 ♂ *T. protracta* as soon as it was dropped in the jar on July 9.

The stomach of 1 adult ♂ collected 2.6 miles south of Faysville, Hidalgo Co., Texas on August 2, 1939, was empty but that of an immature ♀ from the same wood rat house contained 1 small beetle. The stomach of 1 adult ♀ collected near Congress Junction, Yavapai Co., Arizona, on June 1, 1940, contained mostly large red ants (149 heads), 1 beetle, insect remnants, and a very small amount of plant remains (small twigs). The stomachs of 2 other lizards, adult ♂ and ♀, collected June 1, 1940, from a large boulder brush pile wood rat house 5 miles west of Wickenburg, Maricopa Co., Arizona, contained the following: ♂, 8 red ants (heads mostly), 3 beetles, 1 beetle larva, 1 adult ant lion (Myrmeleonidae), 1 hairy spider, a small leaf, and twig remnants; ♀, 290 red ants (heads mostly), 2 crickets, 1 beetle, and other insect remnants.

Desert Horned Lizard, *Phrynosoma platyrhinos*. On May 18, 1942, the writer saw 1 immature lizard eat 1 small nymph of *Triatoma longipes*. One adult ♂ ate 3 medium nymphs of *T. rubida* as soon as the bugs were placed in the cage on May 25, 1942.

Southern California Alligator Lizard, *Gerrhonotus multicarinatus webbiai*. On October 30, 1938, one adult ate 1 ♂ *Triatoma protracta* as soon as it was placed in the cage. One adult ate 8 small nymphs (of 11 placed in the jar) of *T. longipes* on May 22, 1942, over a 48-hour period; 5 medium nymphs of *T. protracta* on May 24 over a 24-hour period; and 4 ♂ and 1 large nymph of *T. rubida* on July 3, but it refused to eat others offered on the latter date.

The stomachs of 2 adult lizards captured August 28, 1936, from wood rat houses near Eaton Canyon Dam, Pasadena, Los



Angeles Co., California, contained the following: no. 1, one beetle, 1 spider, and other insect remnants, and no. 2, one grasshopper and 1 beetle.

Yucca Night Lizard, *Xantusia vigilis*. On May 18, 1942, seven adults and 1 immature lizard ate 21 small *Triatoma longipes* nymphs over a 24-hour period. On May 20, 1942, one immature lizard ate 1 of 10 small nymphs of *T. longipes*. On May 21, 1942, thirty-five small nymphs of *T. longipes* were placed in a jar with 7 adult *Xantusia*. The lizards immediately began to feed on the bugs and by May 25, twenty-eight had been eaten and 2 dead were removed which had been mouthed by the lizards.

Arizona Night Lizard, *Xantusia arizonae*. The stomach of 1 lizard collected June 1, 1940, under a rock slab with a *Triatoma longipes* at the Alvarado Mine, near Congress Junction, Yavapai Co., Arizona, contained 1 small red ant plus other insect remnants.

Western Worm Snake, *Leptotyphlops humilis humilis*. On May 18, 1942, two adults were placed in a 10 inch petrie dish with 26 small nymphs of *Triatoma longipes*. Forty-eight hours later none of the bugs had been eaten.

Red Racer, *Coluber flagellum frenatum*. One adult did not feed on 10 small nymphs of *Triatoma longipes* over a 48-hour period, 5 medium nymphs of *T. protracta* over a 24-hour period, or 2 ♂ *T. rubida* over a 24-hour period.

Desert Leaf-nosed Snake, *Phyllorhynchus decurtatus perkinsi*. One specimen did not eat 5 small nymphs of *Triatoma longipes* or 2 small nymphs of *T. rubida* over a 24-hour period.

Western Glossy Snake, *Arizona elegans occidentalis*. One adult did not feed on 10 small nymphs of *Triatoma longipes* over a 48-hour period, 3 medium nymphs of *T. protracta* over a 24-hour period, or 2 ♂ *T. rubida* over a 24-hour period.

## DISCUSSION

Other studies (Burt, 1931; Knowlton and Janes, 1932, 1933; Van Denburgh, 1922) have revealed the presence of Hemiptera, including representatives of the Reduviidae, in the diet of southwestern lizards but none of the genus *Triatoma* (*Conorhinus*) was found.

None of the insect remnants seen in the stomachs of these lizards contained *Triatoma* remains yet many of them were col-

lected in areas where these blood-sucking insects are fairly abundant. A check of the distribution of *Triatoma* (Wood, 1941) shows definite overlapping with territories occupied by many of these reptiles. At least, it is evident that *Triatoma* does not constitute an abundant food item of the lizards examined although further search may reveal some genera, especially *Sceloporus*, as of importance as a natural control agent of cone-nosed bugs.

## SUMMARY

Cone-nosed bugs (*Triatoma* spp.) were eaten voluntarily by 8 species of lizards. No *Triatoma* were found among the insects seen in the stomachs of lizards collected in the field habitat of the bugs.

## BIBLIOGRAPHY

- Burt, C. E. 1931. A study of the teiid lizards of the genus *Cnemidophorus* with special reference to their phylogenetic relationships. Bull. U. S. Nat. Mus., no. 154, 1-286.
- Derbonne, W. 1934. *Coleonyx* in captivity. Copeia, no. 4, 191.
- Knowlton, G. F. and M. J. Janes. 1932. Studies of the food habits of Utah lizards. Ohio Jour. Sci., 32, 467-470.
1933. Lizards as predators of the beet leafhopper. Jour. Econ. Ento., 26, 1011-1016.
- Van Denburgh, J. 1922. The Reptiles of western North America. I. Lizards. Occ. Papers Calif. Acad. Sci., 10, 1-611.
- Wood, F. D. and S. F. Wood. 1938. On the distribution of *Trypanosoma cruzi* Chagas in southwestern United States. Am. Jour. Trop. Med., 18, 207-212.
- Wood, S. F. 1941. Notes on the distribution and habits of Reduviid vectors of Chagas' disease in the southwestern United States (Hemiptera, Reduviidae). Pan-Pacific Ento., 17, 85-94, 115-118.
1942. Observations on vectors of Chagas' disease in the United States. I. California Bull. So. Calif. Acad. Sci., 41, 61-69.
1943. Observations on vectors of Chagas' disease in the United States. II. Arizona Am. Jour. Trop. Med., 23, 315-320.
1944. The reptile associates of wood rats and cone-nosed bugs. Bull. So. Calif. Acad. Sci. (in press).



# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,

Los Angeles 7, Calif., U. S. A.

---

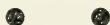
## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.



## Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1943, including volumes XXIV to XLII, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

### MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939.

# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 1, 1926 .....	2.00	4.00
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50
" 42, " 1, 2, 3, 1943 (each) .....	.25	.50
" 43, " 1, 2, 1944 (each) .....	.25	.50

*(Continued on next page)*

# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ “ printed on one side of page (bound) .....	2.75	4.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published) ...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall .....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfami- lies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....	\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....	.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....	3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis	.50

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES  
(Care Dr. JOHN A. COMSTOCK)

Los Angeles Museum, Exposition Park,  
Los Angeles 7, Calif., U. S. A.



# The SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*announces the publication of Part 2, Volume 2 of its*

## "MEMOIRS"

containing the "REVISION OF THE NORTH AMERICAN GENERA AND SPECIES OF THE PHALAENID SUB-FAMILY PLUSIINAE (LEPIDOPTERA)" by J. McDUNNOUGH, Ph. D.

58 pp., 6 Pl. Price \$1.50 postpaid.

This paper completes the first two volumes of the Memoirs.

Attention of Librarians is called to the fact that all issues of this publication are still available, and may be obtained from the Secretary of the Academy at the prices, and in the editions noted below.

The "Memoirs" are financed from a special fund that is required to be replenished from the sale of the publication, and it is therefore impossible for the Academy to furnish these on an exchange basis. Regular members of the Academy, in good standing, are furnished a copy of each issue as published, without cost, and are privileged to order additional copies at 50% of the publication price.

### MEMOIRS ISSUED TO DATE:

- Vol. 1. Complete in one issue. 275 pp. 1938. Contains "Check List of the Lepidoptera of Canada and the United States of America; Part 1; Macrolepidoptera", with Index and Corrigenda, by J. McDunnough, Ph.D. Paper Cover.....\$4.00
- A few copies bound in black buckram..... 5.00
- Special edition of the above, printed on one side of page only, with every facing alternate page blank, making possible the write-in of notes and new species. Paper cover.....\$5.00 Bound..... 6.00
- A limited edition of the List, without index, was run on white bristol board, suitable for use as cut-out labels. A few are available at..... 3.00
- Vol. 2, Part 1. 172 pp. 1939. "Check List of the Lepidopt. of Canada and the U. S. Part 2, Microlepidoptera", with Index, by J. McDunnough, Ph.D. Papers..... 2.50
- A few copies of the special edition, printed on one side of page only.....paper 3.50
- Vol. 2, Part 2, as announced above..... 1.50

*Address all orders and inquiries to*

THE SECRETARY

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

c/o Los Angeles County Museum

Exposition Park

Los Angeles 7, Calif., U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

#### Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of..... Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

#### Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.....), here describe the property or ground rent....., together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# P R I N T I N G

Books • Catalogs • Broadsides  
Stationery and Office Forms



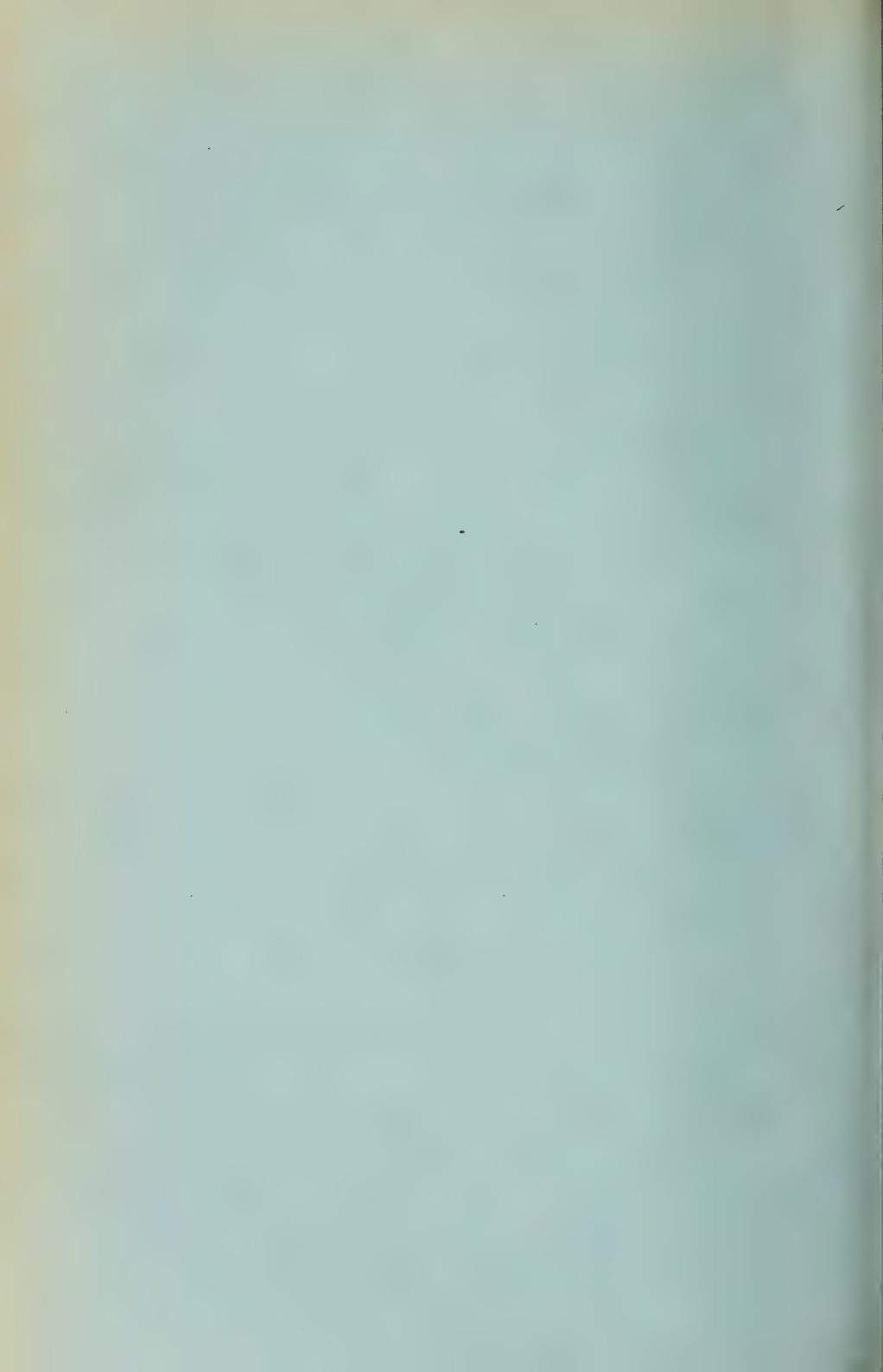
## McBRIDE PRINTING CO.

PHONE: PROspect 2045

415 EAST ELEVENTH ST.

Los Angeles 15, Calif.

*"Since 1879"*



BULLETIN OF THE  
Southern California  
Academy of Sciences

LOS ANGELES, CALIFORNIA

*Mostra tuendum ipsi.*



VOL. XLIII

SEPT. - DEC., 1944

PART 3

CONTENTS

*Page*

NOTES ON PACIFIC COAST MARINE ALGAE, I:	
E. Yale Dawson	95
SOME NEW AND UNREPORTED SUBLITTORAL ALGAE	
FROM CERROS ISLAND, MEXICO:	
E. Yale Dawson	102
BRIEF NOTES ON THE EARLY STAGES OF THREE CALIFORNIA	
MOTHS:	
John A. Comstock and Charles M. Dammers	113
FURTHER REPORT ON A CHIGOE-LIKE FLEA FROM	
CALIFORNIA:	
Gustaf F. Augustson	119
SOME BUTTERFLIES OF SEQUOIA NATIONAL PARK:	
T. B. and H. M. Blevins	122



# Southern California Academy of Sciences

## OFFICERS and DIRECTORS

DR. W. DWIGHT PIERCE-	- - - - -	<i>President</i>
DR. H. J. ANDREWS -	- - - - -	<i>First Vice-President</i>
DR. WILLIAM L. LLOYD -	- - - - -	<i>Second Vice-President</i>
DR. JOHN A. COMSTOCK.	- - - - -	<i>Secretary and Treasurer</i>
DR. H. J. ANDREWS		DR. WILLIAM L. LLOYD
DR. A. WIER BELL		MR. THEODORE PAYNE
DR. JOHN A. COMSTOCK		DR. W. DWIGHT PIERCE
MR. SAMUEL MOODY HASKINS		DR. ROBERT L. RUTHERFORD
DR. HOWARD R. HILL		DR. CHESTER STOCK

MR. R. S. WOGLUM

## ADVISORY BOARD

MR. FRED E. BURLEW	DR. R. H. SWIFT
MR. A. YORK ESCALANTE	DR. SHERWIN F. WOOD

## BOTANICAL SECTION

MR. THEODORE PAYNE, *Chairman*

## SECTION OF HEALTH AND SANITATION

DR. H. J. ANDREWS, *Chairman*

## SECTION OF ZOOLOGICAL SCIENCES

DR. A. WIER BELL, *Chairman*

## SECTION OF CHEMICAL SCIENCES

DR. HARRY J. DEUEL JR., *Chairman*

## SECTION OF EARTH SCIENCES

DR. CHESTER STOCK, *Chairman*

## SECTION OF PHYSICAL SCIENCES

DR. PRESTON K. CAYE, *Chairman*

## SECTION OF AGRICULTURAL SCIENCES

MR. RUSSELL S. WOGLUM, *Chairman*

## SECTION OF JUNIOR SCIENCE

DR. WILLIAM L. LLOYD, *Chairman*

## ARCHEOLOGICAL SECTION

DR. R. H. SWIFT, *Chairman*

## FINANCE COMMITTEE

MR. FRED E. BURLEW, <i>Chairman</i>	
MR. SAMUEL MOODY HASKINS	DR. JOHN A. COMSTOCK

## PROGRAM COMMITTEE

DR. ROBERT L. RUTHERFORD, <i>Chairman</i>	DR. HOWARD R. HILL
---	--------------------

## HOSPITALITY COMMITTEE

MISS BARBARA LOOMIS, *Chairman*

## COMMITTEE ON PUBLICATION

DR. JOHN A. COMSTOCK, <i>Chairman</i>	
DR. CHESTER STOCK	DR. WILLIAM L. LLOYD

## OFFICE OF THE ACADEMY

Los Angeles County Museum, Exposition Park, Los Angeles 7, Calif.

## NOTES ON PACIFIC COAST MARINE ALGAE, I

By E. YALE DAWSON

Since the publication of *A Review of the Genus Rhodymenia* (Dawson, 1941) the author has made a special effort to detect reproductive material of the several species of *Rhodymenia* known from southern California. Except for occasional tetrasporic examples of *R. californica* and *R. attenuata*, such material has proved generally to be rare or at least uncommon. Tetrasporic plants of *R. californica* are fairly common at La Jolla on lower littoral rocks, and in October and November a few cystocarpic examples have been found. The cystocarps are mostly borne on essentially unmodified blades and resemble those of *R. attenuata* originally described from material collected at Carmel. The tetrasporic type of *R. attenuata* came from San Pedro.

Both tetrasporic and cystocarpic plants were described for *Rhodymenia lobulifera* (Dawson, 1941) and for a time it was suspected that these might represent reproductive stages then unknown for *R. pacifica*. Recently discovered tetrasporic material of the latter, however, tends to distinguish these two plants further, for the tetrasporic lobules of *R. pacifica* were found at or near the apices of the broadly rounded main blades, while those of *R. lobulifera* occur on the upper margins of attenuated blades.

When *Rhodymenia palmettiformis* was first described, a plant from Monterey was referred to it. Smith (1944) has referred this specimen to *R. pacifica*, and the author is now in agreement, having examined numerous specimens of *R. palmettiformis* in the field in southern California. In San Diego County this plant is very distinct from other Rhodymeniae. Its usually short stipe, generally unbranched except by stoloniferous branching from the very base, is distinctive. It is a larger, coarser plant than *R. californica* and is less strictly dichotomous. Hundreds of plants examined in the lower littoral at La Jolla during spring and summer failed to show reproduction. Mr. David Fork, however, found a cystocarpic plant cast up at La Jolla on October 20, 1944 and shortly thereafter the author obtained several cystocarpic examples from lower littoral rocks near Scripps pier, La

Jolla. These plants bear abundant cystocarps protruding from the surfaces of small terminal or marginal proliferous extensions of the subdichotomous main blades. These may take the form of small, flabellate, pedicellate, marginal bladelets. The cystocarps are smooth, hemispherical, 550-650 micron in diameter, with unraised ostiole. Several tetrasporic plants were found November 4 in beach drift by Mr. Max Hommersand. On these the tetrasporangia were borne in short, flabellate, pedicellate bladelets arising in various positions from the margins of the main blades, seldom near the apices. In one instance a number of such bladelets were proliferous from the surface of a damaged blade. The sori are more or less clearly nemathecoid; the tetrads elongated.

Tetrasporic plants best referred to *Rhodymenia rhizoides* were obtained November 4, 1944. These plants, except for their more abundant stolons and longer, much branched stipes resemble *R. palmettiiformis*. The tetrasporangia are borne in bladelets similar to those of *R. palmettiiformis*, though often themselves rather long-stipitate, and occur promiscuously on the older frond parts, arising both from margins and surfaces of blades and stipes. The sori are nemathecoid in section with much elongated tetrads. Cystocarps are still unknown.

Reproductive material of *Rhodymenia arborescens*, originally described from a sterile plant cast ashore at Laguna Beach, is yet to be discovered.

#### AEGIRA VIRESCENS (Carmichael) Setchell & Gardner

During the early part of June, 1944, plants of this species bearing abundant unilocular zoosporangia were found growing in middle littoral tide pools near the "Beach Club", La Jolla. Heretofore, its distribution on the Pacific coast has been recorded only as "Shumagin Islands to Sitka, Alaska" (Setchell & Gardner, 1925). That it has turned up in fair abundance so far south without having been reported in the long interval between Alaska and southern California is somewhat surprising. It is, however, a widespread plant of cool and cold waters in both the Atlantic and the Pacific, and the cool winter and spring waters of the San Diego region are apparently well within its limits of tolerance. No specimens have been found during the summer and fall seasons of warmer water.

#### BINGHAMIELLA FORKII sp. nov.

Fig. 5

Frondes epiphyticae, 3-4-ies dichotomae, segmentis majoribus divaricatis, complanatis, pro more 1 mm. latis vel minoribus in

partibus infernis minimis, ad dichotomias superas maximis 2.5 mm.; ramis pinnatis secundariis conspicue ramosis, interdun dichotomias ipsas occultantibus, pinnis irregulariter ortis 1-5 mm. longis, saepius basi coarctatis; tetrasporangiis in soris pro more utrinque in parte maiore dichotomiarum terminalium pinnarumque sitis; soris generis.

Fronds epiphytic, adherent at most points of contact with the host by means of small discs or ridges of attachment tissue arising from modified epidermal cells, 3-4 times dichotomous, 1-2 cm. high, the main segments divaricate, complanate, at first completely cellular but soon becoming lacunose and progressively more hollow, finally with only scattered filamentous cells running through the central cavity, usually 1 mm. wide or less in lower, narrower parts, up to 2 mm. wide at broadest upper dichotomies; pinnate secondary branching conspicuous, sometimes almost obscuring the dichotomies, the pinnae arising irregularly, 1-5 mm. long, commonly narrowed at the base, particularly in tetrasporic individuals; tetrasporangia borne in sori usually occupying the larger part of both sides of terminal dichotomies and of pinnae; sori consisting of groups of tetrahedrally divided tetrasporangia arranged in shallow pits in the surface tissue of the frond.

TYPE: (tetrasporic) epiphytic on *Gelidium pyramidale* and *Hypnea californica* cast ashore at La Jolla, California, October 22, 1944. Collected by David Fork and deposited in the Herbarium of the University of California.

It was surprising to find a distinctive second member of this genus until lately (Setchell & Dawson, 1941) so neglected and ill known. *Binghamiella californica* is known to occur on the California coast only between Redondo and Santa Barbara. *B. Forkii* is found in a somewhat different, more southern algal province, and exhibits an epiphytic habit entirely unlike *B. californica*. The latter plant, whose habitat is apparently confined to sublittoral rocks, arises from a small discoid holdfast, which may also bear a few small stolons, and possesses a short, but well defined, slender stipe. No suggestion of epiphytism has been observed in any of the twenty-eight examples examined. *B. Forkii* is a much smaller plant, having a height of no more than 2 cm. when detached from its host. *B. californica* commonly reaches a height of 4 cm. and may be 5 cm. high. Finally, the conspicuous pinnate secondary branching of *B. Forkii* contrasts sharply with the almost completely dichotomous branching of *B. californica*.



## LAURENCIA SNYDERAE nom. nov.

Figs. 1-4

Frondes steriles statu juvenili stoloniferae prostratae cylindricae, in cumulis caespitosis optime adhaerentibus coadunatae, in scopulis ope discorum crebrorum e parte infera ortorum minorum insidentibus; stolonibus ramulos numerosos breves suberectos steriles edentibus; ramis maturis fertilibus singulis vel 2-5 e pulvine humili vegetativo, quove axi primario carnoso cylindrico percurrente 8-12 cm. longo constante, ramis lateralibus irregulariter dispositis indeterminatis 2-4 cm. longis saepius in apice caulis primarii glomeratis aucto, corpore toto compacte ramulis brevibus determinatis 1.5-3 mm. longis armato, ramulis demum in stichidiis 4-sporicis, vel cystocarpicis abeuntibus (ramulis antheridialibus ignotis); stichidiis simplicibus, 600-700 micron pro more statu maturo hinc inde leviter constrictis; ramulis cystocarpicis quam stichidiis brevioribus, diametro autem pari, saepius cystocarpium singulum, interdum 2, gerentibus; cystocarpiis sessilibus, basi paulum coarctatis, apice humili conico; ramis transverse sectis cellulas superficiales "*palisade*" ratione dicta dispositas nullas exhibentibus; regionibus lenticularibus in-crassatis nullis.

Vegetative fronds in juvenile state forming small, caespitose, closely adherent clumps of prostrate, cylindrical stolons, attached to rock surfaces by frequent small discs from the under surfaces; stolons with abundant short, semi-erect vegetative branches; mature, reproductive shoots arising singly or in groups of two to five from the low, vegetative clump, each consisting of a fleshy, cylindrical, percurrent, main axis 8-12 cm. long with several indeterminate lateral branches 2-4 cm. long arising irregularly or often as a group from an upper portion of the main axis, the whole closely and densely clothed with short, determinate branches 1.5- 3 mm. long, these becoming tetrasporic stichidia or bearing cystocarps (antheridial branchlets not seen); stichidia simple, 600-700 micron in diameter, generally showing a number of slight constrictions when mature; cystocarpic branchlets shorter than stichidia but of the same diameter, usually bearing a single, sometimes two, cystocarps; cystocarps sessile, somewhat constricted at the base, with a low, conical apex; branches in transverse section showing no palisade arrangement of surface cells; lenticular thickenings not present.

TYPE: (cystocarpic) upper surfaces of rocks in the middle littoral, La Jolla, California, October 8, 1900. Collected by Mary S. Snyder.



(tetrasporic) growing on upper surfaces of exposed middle littoral rocks, on the reef near the "Beach Club", La Jolla, California, May 23, 1943. Dawson 115-43. Both type specimens are deposited in the Herbarium of the University of California.

For want of a better designation and because of its generally papillate appearance, this southern California species has long been called *Laurencia papillosa* (Dawson, 1944) a plant with which it certainly is not to be associated nor confused. *Laurencia papillosa* from the Red Sea, and said to be widely distributed in warmer seas, although showing considerable superficial resemblance, does not exhibit the degree of percurrent growth and sparsity of branching characteristic of *L. Snyderae*. Moreover, its surface cells are strongly elongated radially to form a palisade layer according to which it has been arranged in Section Palisadae by Yamada (1931). The characters of *L. Snyderae* place it in Yamada's Section Cartilagineae. The inadequacy of authentic material of *L. papillosa* prohibits comparison or reproductive characters.

*Laurencia Snyderae* is a rather strict inhabitant of the middle littoral where it grows tenaciously attached by its basal cushion of vegetative, stoloniferous branches to the most exposed and barren of surf-beaten rocks. Its time of best development is middle to late summer, maximum luxuriance having been observed in July. Tetrasporic material has been collected as early as May 15. Dying and disintegration of the reproductive fronds occurs during late October and throughout the winter only the small vegetative tufts, very different in appearance from the mature plants, are present.

Cystocarpic and antheridial plants have not been observed in nature. At La Jolla, they have been repeatedly sought for, but the examination of large numbers of individuals both in July and October failed to reveal sexual material, all specimens being abundantly tetrasporic.

Acknowledgments are due to Dr. H. L. Mason of the Herbarium of the University of California for the loan of specimens under his care, and to Dr. Leon Croizat for preparing the latin diagnoses.

## LITERATURE CITED

Dawson, E. Y.

1941. A Review of the Genus *Rhodymenia* with descriptions of New Species. Allan Hancock Pacific Exped. 3 (8): 121-181.

1944. Some New *Laurenciae* from Southern California. *Madroño* 7(8): 233-240.

Setchell, W. A. & E. Y. Dawson

1941. *Binghamia* the Cactus vs. *Binghamia* the Seaweed. *Proceed. Nat. Acad. Sci.* 27(8): 376-381.

Setchell, W. A. & N. L. Gardner

1925. The Marine Algae of the Pacific Coast of North America. Part 3, *Melanophyceae*. *Univ. Cal. Publ. Bot.* 8: 383-898.

Smith, G. M.

1944. Marine Algae of the Monterey Peninsula. 1-622, 98 pls. Stanford Univ.

Yamada, Y.

1931. Notes on *Laurencia* with special reference to the Japanese Species. *Univ. Cal. Publ. Bot.* 16: 185-310.

## EXPLANATION OF FIGURES

## PLATE 19

- Fig. 1. *Laurencia Snyderae*. A tetrasporic specimen showing the characters of branching and of the stichidia of plants inhabiting semi-protected places. X 1.
- Fig. 2. *Laurencia Snyderae*. A tetrasporic specimen showing characters of unprotected, more completely exposed plants. X 1.
- Fig. 3. *Laurencia Snyderae*. A tetrasporic stichidium. X 23.
- Fig. 4. *Laurencia Snyderae*. A cystocarpic branchlet. X 23.
- Fig. 5. *Binghamiella Forkii*. Portion of tetrasporic plant growing on *Hypnea californica*. X 3.

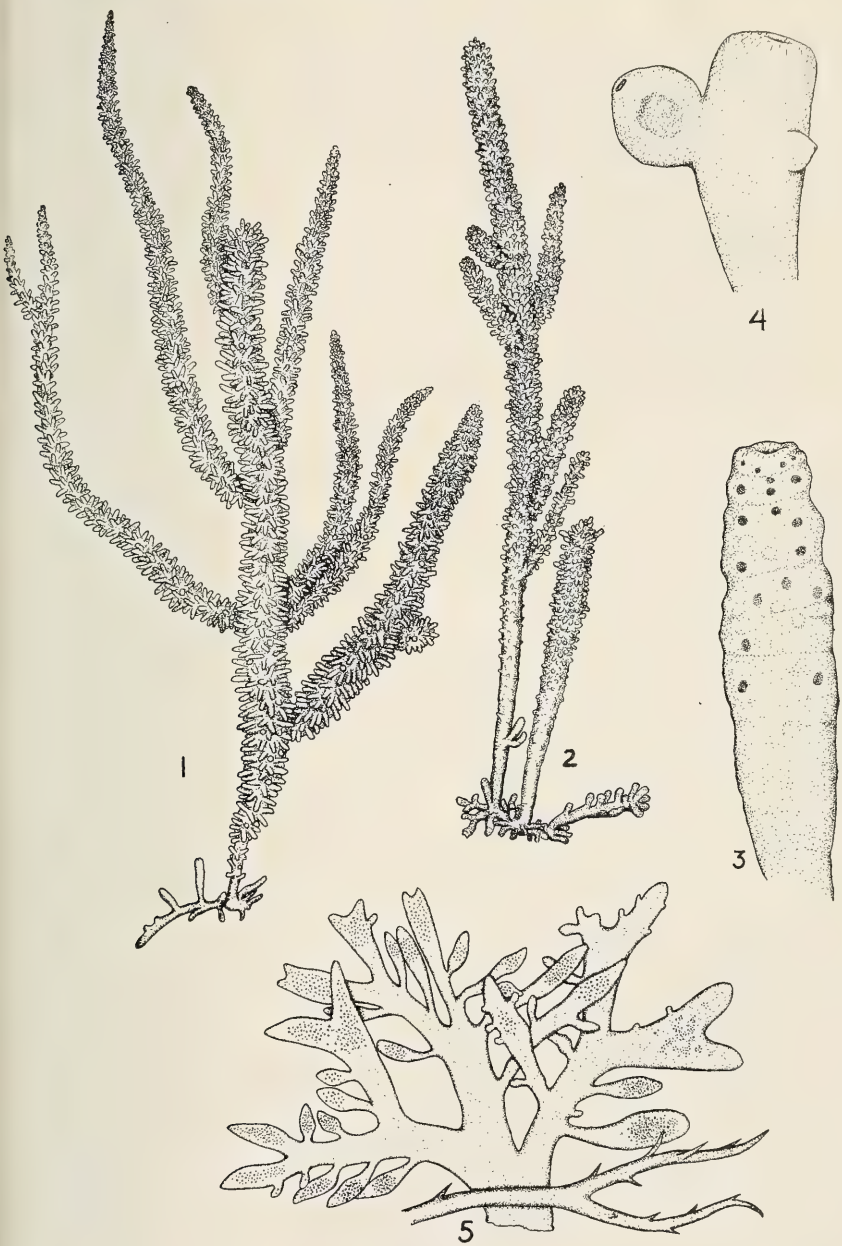


PLATE 19

SOME NEW AND UNREPORTED SUBLITTORAL  
ALGAE FROM CERROS ISLAND, MEXICOBy E. YALE DAWSON<sup>1</sup>

Our knowledge of the marine flora in the vicinity of Cerros Island, Baja California is exceedingly scant. Except for the considerable number of species reported from outlying Guadalupe Island (Setchell and Gardner 1930) the literature is almost devoid of information concerning the marine algae of any part of the Pacific coast of Baja California south of Ensenada. From a small collection dredged in the Cerros Island area in 1932 by J. T. Howell of the Templeton Crocker Expedition of the California Academy of Sciences, Setchell and Gardner, 1937, detected two new species which they named *Weeksia Templetonii* and *Weeksia Howellii*. No other species are recorded from Cerros Island, for the remainder of the collection was never completely worked over and probably is still to be found in the Herbarium of the University of California.

The present material, all of which is preserved at the University of California, consists of specimens taken from the surfaces of rocks of two geological samples dredged during the month of May from depths of 25-30 meters and 40-50 meters in Kellett Channel between the south shore of Cerros Island and Natividad Island. Beside the new species described in this paper, a few other plants were identified with some confidence and noted below. A number of sterile specimens, some of which are undoubtedly undescribed, remain without names awaiting the discovery of fertile material.

In the 25-30 meter dredging *Acrosorium uncinatum* (J. G. Agardh) Kylin occurred in abundance. A few specimens of *Polyncura latissima* (Harvey) Kylin and *Pterosiphonia dendroidea* (Montagne) Falkenberg were found. Specimens which cannot be distinguished from *Peyssonnelia pacifica* Kylin were occasional, and one rock bore a number of fragments (mostly attachment discs and lower parts of plants) which seem to be *Desmarestia munda* Setchell and Gardner.

In the 40-50 meter dredging, except for the several new species here described, *Phycodrys Setchellii* Skottsberg was the only identifiable plant.

<sup>1</sup>The writer wishes to acknowledge here the loan, by Dr. H. L. Mason, of specimens from the Herbarium of the University of California for use in this study, and also to thank Dr. Leon Croizat for preparing the latin diagnoses.

## SCINAIA MINIMA sp. nov.

Fig. 1

Frondibus 2-4 cm. longis, cylindricis, 1.5-2.5 mm. diam., in basem arctam confluentibus, 3-4-ies dichotomis econstrictis; epidermide ex utriculis magnis incoloribus, 20-23 micron altis, 15-18 micron latis; cellis hypodermicis in strato singulo, 10-12 micron diam.; cystocarpiis parvis, per frondem irregulariter dispositis, immersis, 200-275 micron diam., fauce 50-75 micron longa.

Fronds 2-4 cm. high, from a small, discoid holdfast, cylindrical, 1.5-2.5 mm. diam., tapering to a slender base, 3-4 times dichotomous, smooth, without constrictions, the apices narrowed but blunt; axils rather narrow; epidermis of large, colorless, more or less flat-topped cells, or utricles, 20-23 micron high, 15-18 micron diam., mostly hexagonal in surface view; hypodermal cells more or less spherical, in a single, closely set layer, mostly 10-12 micron diam.; cystocarps small, scattered irregularly over the frond, immersed, spherical or broadly pyriform, 200-275 micron diam., with a nearly cylindrical neck 50-75 micron long; gonimoblasts very numerous, radiating to form a very compact, nearly spherical, basally attached mass; periderm thin, of about 2 layers of pseudoparenchymatous cells, or these in distinct filaments above.

TYPE: Dredged in May from a cobblestone bottom at a depth of 25-30 meters, Kellett Channel, south shore of Cerros Island, Baja California, Mexico. (cystocarpic).

*Scinaia minima* is closely related to *S. Johnstoniae* Setchell, known from both southern California and the Gulf of California, but differs in a number of ways. The following comparison points out some of these.

	<i>S. minima</i>	<i>S. Johnstoniae</i>
Height .....	2-4 cm.	8-12 cm.
Number of dichotomies.	3-4	7-8
Diam. of main parts....	1.5-2.5 mm.	3-5 mm.
Diam. of utricles.....	15-18 micron	21-25 micron
Diam. of hypodermal cells	mostly 10-12 micron	16-28 micron
Height of cystocarp....	180-285 micron	128-170 micron
Diam. of cystocarp.....	200-275 micron	180-265 micron
Periderm .....	of about 2 layers of pseudoparenchymatous cells or these distinctly filamentous above.	of about 4 layers of pseudoparenchymatous cells.



## LEPTOFAUCHEA PACIFICA sp. nov.

Figs. 2-3

Frondibus 3-4 cm. altis, stipitibus ramosis 6-8 mm. longis; laminis abrupte dilatatis, basi late cuneata, dichotomo-flabellatim ramosis, levibus, flaccidis, segmentis inferioribus ad 4 mm. latis, infimis 2 mm. latis vel minus; segmentis 90-130 micron crassis, medullae stratis 2 irregularibus, cellis latis, incoloribus; corticis re ipsa strato singlo cellularum parvarum pigmentatarum 7-14 micron diam.; soris tetrasporangicis nemathecialibus, ellipticis, vix supra dichotomia segmentorum superiorum impositis; tetrasporangiis cruciatim partitis, 37-45 micron longis, 22-30 micron diam.; cystocarpiis marginalibus in segmentibus applanatis totis, sessilibus, hemisphaericis, 750-800 micron diam.

Fronds 3-4 cm. high, from a small, irregular disc-hold-fast from which arise one or two very slender, branched stipes 6-8 mm. long; blades expanding abruptly from a broadly cuneate base, dichotomo-flabellately branched, thin, flaccid, the lower segments up to 4 mm. broad (broader in cystocarpic than in tetrasporic plants) the ultimate segments 2 mm. broad or less, with blunt or rounded apices; segments 90-130 micron thick, composed of a medulla of two irregular layers of large, colorless cells and a cortex essentially of a single layer of very much smaller, pigmented cells varying in greatest diameter from 7-14 micron; tetrasporangial sori nemathecial, appearing as elliptical bands, mostly just above the points of forking of the upper segments and nearly as broad as the segments; sori composed of slender, branched, paraphysal filaments 8-12 cells or about 75 micron long, arising from cortical cells, some sterile, others bearing tetrasporangia; tetrasporangia ovate, cruciately divided, arising as 1-celled lateral branches from paraphysal filaments, 37-45 micron long, 22-30 micron diam.; cystocarps marginal on all flattened segments, sessile, hemispherical, 750-800 micron diam., with prominent but low terminal, ostiolar papilla, carpospores in a compact, spherical mass surrounded in the cavity by a network of filaments arising from the auxilliary cell.

TYPE: On rocks dredged in May from a depth of 40-50 meters in Kellett Channel, south shore of Cerros Island, Baja California, Mexico. (tetrasporic and cystocarpic).

*Leptofauchea pacifica* is closely related to *L. rhodymenioides* Taylor 1942, from Aruba Island in the Dutch West Indies. It is however, a species of only about one half the dimensions of *L. rhodymenioides*, and with a much better defined, branched stipe. The thinner, smaller, blades have a medulla of only two layers

of large medullary cells, sharply set off from the very small cells of the cortex; Taylor's plant is shown to have more layers in the medulla and these grade into the cortex somewhat. The reproductive structures both cystocarpic and tetrasporic are quite similar to those of Taylor's plant and agree with Kylin's concept of the genus.

SCIADOPHYCUS GEN. NOV.

*Frondibus peltatis, stipitatis, primo simplicibus, dein ratione sympodica lateraliter compositis; laminis e strato medullari unico, cellis facto maximis, incoloribus, stratis corticalibus 1-2, cellulis minoribus, pigmentatis, tetrasporangiis in nematheciis parvis pustulosis coacervatis per laminam sparsis cruciatis; cystocarpiis hemisphaericis, ostiolatis, fibris sterilibus in antro carposporico abundantibus.*

Fronds peltate, stripitate, at first simple, later compound by sympodial growth from the base of marginal extensions of the primary blade; blades composed of a single medullary layer of very large, colorless cells, and one or two cortical layers of very much smaller, pigmented cells; tetrasporangia in small, blister-like nemathecia scattered over surface of blade, cruciate, arising as one-celled fertile filaments from cortical cells, surrounded by multicellular, branched, sterile filaments from the same or adjoining cortical cells; cystocarps hemispherical, smooth, ostiolate, with abundant sterile fibers within the carposporic cavity.

SCIADOPHYCUS STELLATUS sp. nov.

Figs. 6-16; 19

*Frondibus peltatis, stipitatis, stipite 5-16 mm. longo; lamina peltata primo simplici, rotunda, concava, demum 4-6 cm. lata, punctos 10-14 stellatos radiantes evolvente, ramulos ratione sympodica ferentes; laminis 200-250 micron crassis. Caeteris generis.*

Fronds peltate, stipitate, the stipe 5-16 mm. high, simple or sometimes once forked, uniformly cylindrical or more commonly irregularly swollen below by amplification of the cortical tissue of the stipe; cells of swollen portion of stipe filled with spherical granules of floridean starch, often chalky white in color; peltate blade at first simple, rotund, concave, becoming 4-6 cm. broad and developing 10-14 radiating, star-like points, each terminated by a terete, secondary attachment organ arching toward the substratum; branching sympodial by development of secondary blades from the upper surface of the primary blade at a point usually 2-3 mm. back of the tip of each secondary attachment organ; tertiary blades and attachment organs developed

in the same manner; blades 200-250 micron thick, the medulla of a single layer of a very large, colorless cells, the cortex at first of a single layer of very much smaller, flattened pigmented cells. later this layer adding to the exterior a layer of still smaller, widely spaced, isodiametric, pigmented cells; tetrasporangia in small, blister-like (80-100 micron thick) nemathecial sori scattered over the surface of the blade, mostly on the upper side; cystocarps hemispherical, smooth, ostiolate, on surface of blades, with a network of sterile filaments surrounding the carposporic mass in the cavity.

TYPE: Growing on rocks dredged in May from a depth of 40-50 meters in Kellett Channel, south shore of Cerros Island, Baja California, Mexico. (tetrasporic and cystocarpic).

Additional Specimen: Dredged in June from a depth of 43 meters off Point Loma, San Diego, California.

The cruciate divisions of the tetrasporangia are typical of both the Faucheae and the Rhodymeniae of the family Rhodymeniaceae. The peltate form occurs in *Faucheia peltata* Taylor 1942, but the sympodial mode of branching is not recorded for any member of the subfamily Faucheae. Some aspects of the sympodial branching resemble those found in the subgenus *Dendrymenia* Dawson 1941, of the genus *Rhodymenia*. A near approach to the vegetative structure of the frond of the present species is found in *Leptofaucheia* Kylin 1931, which has, however, a double rather than a single layer of very large, medullary cells.

Although the vegetative form and structure of the present plant are anomalous, and the tetrasporic characters are not distinctive, the presence of the net-like filaments within the carposporic cavity points conclusively to its arrangement as a member of the subfamily Faucheae of the family Rhodymeniaceae. Only a single, somewhat damaged cystocarp was detected in the type material, but a section was successfully made showing young gonimoblast filaments arising from the auxilliary cells, the fertile ones in a small mass in the center of the carposporic cavity, and surrounded by a network of sterile filaments filling the rest of the cavity. The apex of the cystocarp was largely torn away, but a portion of the ostiole seemed visible. The lower portion of the cystocarp was of solid, cellular tissue, the carposporic cavity being relatively small and occupying a position in the upper half.

The storage of large quantities of floridean starch in the lower portions of the stipe is a peculiar characteristic of this species. Even in very young plants the lower part of the stipe is commonly very much swollen and enlarged from extra cortical growth. Spherical granules of starch begin to accumulate very early, and before the peltate blade is mature every cell of the

stipe within this swollen region may be completely filled with them. Some stipes show only moderate accumulations of starch throughout their lower portions, but in most cases a very sharp line sets off the swollen, chalky-white, starch-filled, lower stipe from the normally pigmented, unenlarged upper part. The starch grains give a deep, red-brown color reaction with iodine.

HYPOGLOSSUM RETUSUM sp. nov.

Figs. 17-18

Frondibus ad 27 mm. (vel ultra) longis, stipite primario cylindrico, laminas laterales irregulariter edente; laminis oblanceolatis, 11-16 mm. longis, 3.5-4.5 mm. latis, in stipite petiolo gracili 2-4 mm. longo insidentibus, costa percurrente excepta monostromaticis, venis lateralibus nullis, apice retusis, puncto vegetativo de-atque reflexo; meristematico acuto cellulae apicalis ope accrescente.

Fronds to 27 mm. high (or more) with a cylindrical main stipe from which several blades arise irregularly as lateral branches; blades oblanceolate, 11-16 mm. long, 3.5-4.5 mm. wide, attached to the main stipe by a slender petiole 2-4 mm. long, monostromatic except at the percurrent midrib, without lateral veins, frequently with a series of rhizoids growing from the margin, with an apical notch from which the apical growing point is turned backward and downward, the meristem itself acute and growing by means of an apical cell; intercalary divisions of primary cell row absent; initials of tertiary cell rows reaching the thallus margin; cystocarps, antheridia and tetrasporangia not seen.

TYPE: Dredged in May from a rocky bottom at a depth of 40-50 meters in Kellett Channel, south shore of Cerros Island, Baja California, Mexico.

Although the monostromatic blade and the characteristics of the apical meristem seem to mark this plant as a species of *Hypoglossum*, the generic status should be considered tentative until confirmed or denied by reproductive material. The retuse blade-tip and oddly recurved apical meristem as well as the long-petiolate blades without branches from the midrib are distinctive in this species.

POLYCORYNE PHYCODRICOLA sp. nov.

Figs. 4-5

Thallus *Phycodricis Setchellii* parasiticus, pallido vel subcolori, primo solido, breviter cylindrico vel hemisphaerico, pro-



tuberantis brevibus, cornutis ornato, elongatis pulvinum efformantibus, 2-3 mm. lato; ramulis vegetativis radiatis, subcurvis, brevibus, teretibus, .6-.8 mm. longis, 175-250 micron diam. ope cellulae apicalis accrescentibus.

Thalli parasitic on *Phycodrys Setchellii*, pale or colorless, at first a solid, short-cylindrical or hemispherical body with short, horn-like protuberances, these elongating to form a pulvinate mass, 2-3 mm. in diameter, of radiating, somewhat crooked, short, terete vegetative branches .6-.8 mm. long, 175-250 micron diam., each growing by means of an apical cell; tetrasporangia and cystocarps unknown.

TYPE: Growing on *Phycodrys Setchellii* dredged in May from a depth of 40-50 meters in Kellett Channel, south shore of Cerros Island, Baja California, Mexico.

This deep water, parasitic plant is morphologically similar to *Polycoryne Gardneri* which parasitizes *Nienburgia Andersoniana* on the coast of central California.

#### ERYTHROGLOSSUM sp.

Fig. 20

A very interesting specimen of an undescribed species of *Erythroglossum* was found among the plants dredged from 40-50 meters depth in Kellett Channel. The material is too fragmentary for the formal designation of a new species, but is, nevertheless, described and illustrated below for the information of future collectors in the Cerros Island region.

Frond is to 16 mm. high from a slender, branched stipe less than 0.5 mm. diam.; blades oblanceolate, entire, 9-11 mm. long, 4-4.5 mm. broad, monostromatic except at the percurrent midrib, narrowly cuneate to the base, arising as lateral branches from the stipe or as terminal proliferations from the midrib of older, damaged blades; growth by means of an apical cell; primary cell row with intercalary divisions which prohibit sharp definition of the midrib in early stages; tetrasporangia in small, irregular sori arranged in two rows between the midrib and either margin of the blade, tetrahedrally divided.



## LITERATURE CITED

- Dawson, E. Y.  
1941. A Review of the Genus *Rhodymenia* with Descriptions of New Species. Allan Hancock Pacific Exped. 3 (8): 121-181.
- Kylin, H.  
1931. Die Florideenordnung Rhodymeniales. Lunds Univ. Arsskr. n.f., Avd. 2. 27 (11): 1-98.
- Setchell, W. A. & N. L. Gardner.  
1930. Marine Algae of the Revillagigedo Islands Expedition in 1925. Proceed. Calif. Acad. Sci. iv, 19(11): 109-215.
- 
1937. A Preliminary Report on the Algae of the Templeton Crocker Expedition in 1932. Proceed. Calif. Acad. Sci. iv, 22(2): 65-98.
- Taylor, W. A.  
1942. Caribbean Marine Algae of the Allan Hancock Expedition.  
1939. Allan Hancock Atlantic Exped. Report No. 2: 1-193.

## EXPLANATION OF FIGURES

## PLATE 20

- Fig. 1. *Scinaia minima*. Habit of a cystocarpic plant from the type collection, x 2.
- Fig. 2-3. *Leptofauchea pacifica*: 2, upper portion of a tetrasporic plant from the type collection, x 3; 3, upper portion of a cystocarpic plant from the type collection, x 3.
- Fig. 4-5. *Polycoryne phycodricola*: 4, a very young specimen from the type collection growing through the blade of *Phycodrys Setchellii* and showing the juvenile characters of the species, x 9; 5, a mature specimen from the type collection growing on the stipe of *Phycodrys Setchellii*, x 9.

## PLATE 21

- Fig. 6-16. *Sciadophycus stellatus*: 6, a juvenile specimen attached to a bryozoan colony, x 2; 7, detail of the lower portion of a juvenile specimen showing early development of starch storing portion of the stipe through extra cortical growth, x 4; 8, ventral view of an example from the type collection in which the primary blade is mature and secondary blades and attachment organs are developing, x 1; 9-11, details of stipes to show varying development of swollen, starch storing portion, x 3½; 12, portion of an old specimen showing secondary attachment organs (a) and blades (b) and developing tertiary attachment organs (c) and blades (d), x 2½; 13, detail of secondary attachment organ in contact with substratum, x 10; 14, cross section of a portion of a mature blade, x 68; 15, cross section of a portion of a tetrasporic sorus, x 185; 16, cross section of the tip of a young secondary blade showing development of cellular structure from marginal meristem, x 132.

## PLATE 22

- Fig. 17-18. *Hypoglossum retusum*: 17, habit of the type specimen, x 8½; 18, detail of retuse apex of blade showing acute apical meristem, x 45.
- Fig. 19. *Sciadophycus stellatus*. Lower portion of the specimen from San Diego, California, showing forked stipe, x 5.
- Fig. 20. *Erythroglossum* sp. Habit of a tetrasporic specimen, x 5.

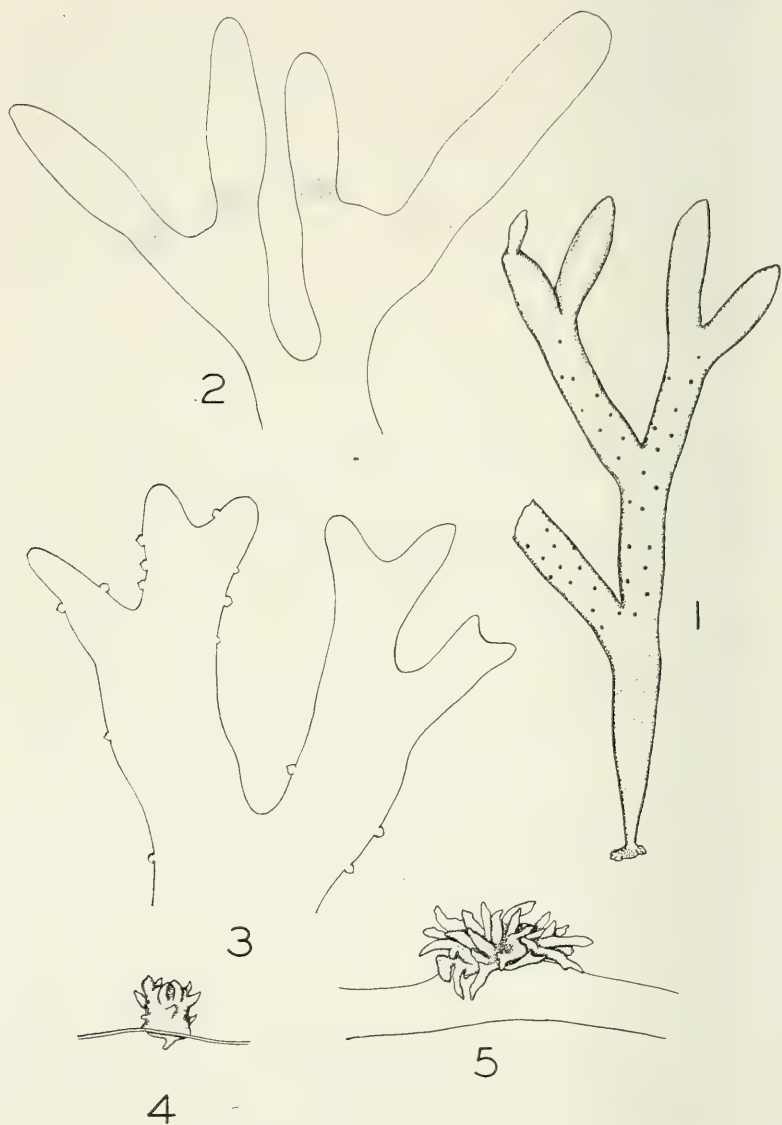


PLATE 20

For explanation of figures see p. 109

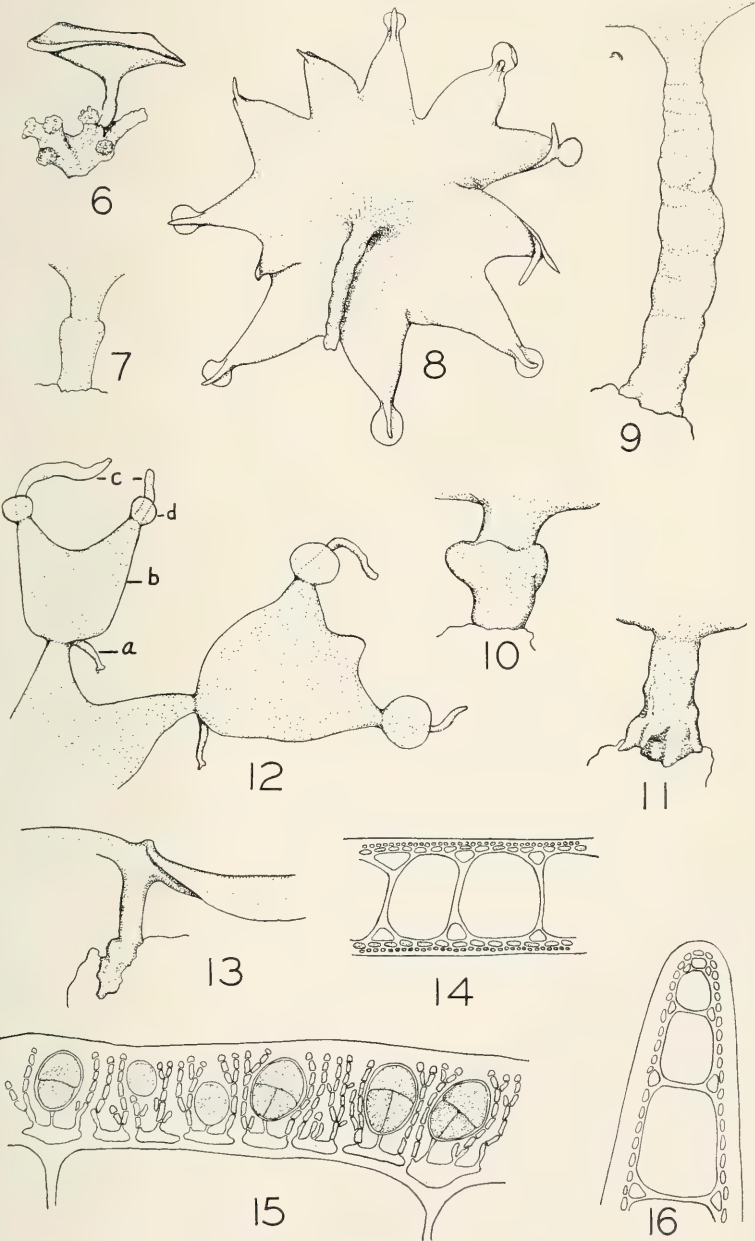


PLATE 21

For explanation of figures see p. 109

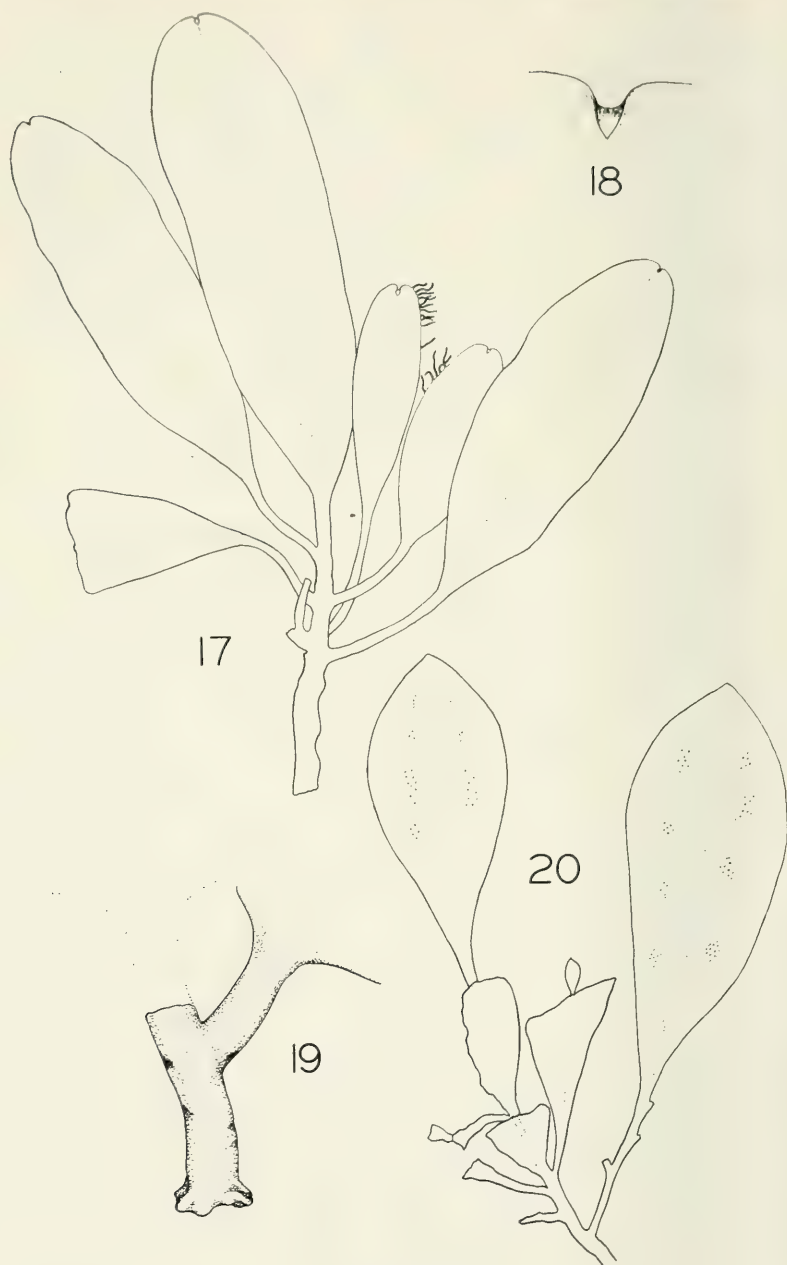


PLATE 22

For explanation of figures see p. 109

## BRIEF NOTES ON THE EARLY STAGES OF THREE CALIFORNIA MOTHS

By JOHN A. COMSTOCK AND CHARLES M. DAMMERS

## HEMIHYALEA EDWARDSII Packard

This Arctiid moth is popularly known as Edwards' Glassy Wing. It is widely distributed throughout California, and its range extends eastward to Colorado and south to Texas.

Packard first described the species in 1864<sup>1</sup>, and Boisduval redescribed it in 1868-9 as *quercus*<sup>2</sup>, which suggests that he was familiar with the larval habits, or at least was aware that it was an oak feeder. Nothing was published on its early stages, however, until 1873 when Capt. Richard H. Stretch<sup>3</sup> gave brief notes on the mature larva and cocoon, and published an exceedingly distorted figure of the larva (Plate 10, fig. 2 of the cited work).

Henry Edwards briefly described the egg and young larva in 1876<sup>4</sup>.

Since that time there has been no mention in the literature of the metamorphosis of this species, notwithstanding that it has been reared many times by western lepidopterists.

The junior author reared the species in 1935 from larvae collected by T. W. Hower on oak, in Orange County, Calif. Our description is drawn from notes taken at that time, supplemented by the published records of Stretch and Henry Edwards.

Egg: Spherical to ovate. Color, according to H. Edwards, "dull yellow, paler on the upper half, and there slightly transparent."

Our notes refer to its color as pale blue, probably due to the fact that our examples were newly laid and infertile. Eggs are deposited in irregular clusters, frequently crowded into fissures of the oak bark, which causes distortion of many examples. Edwards states that "there is no apparent sculpture, the whole surface being smooth and shining." The junior author's notes suggest that it is covered with minute ridges or reticulations and puncturations. The discrepancy in these two statements may have resulted from insufficient magnification.

See Plate 23, fig. A.

<sup>1</sup>Proc. Ent. Soc. Phila. 111: p. 129, 1864.

<sup>2</sup>Ann. Soc. Ent. Belg. XII: p. 81, 1868-9.

<sup>3</sup>Zygaen. and Bomb. N. Am. p. 88, 1873.

<sup>4</sup>Proc. Cal. Acad. Sci. (Pac. Coast Lep. No. 16) VII: 21, 1876.



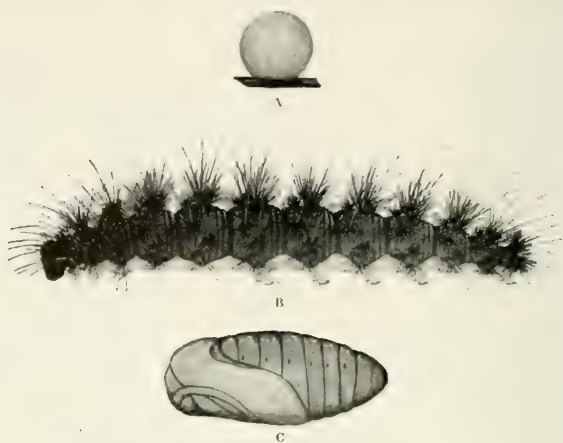


PLATE 23

Early stages of *Hemihyalea edwardsii* Pack.

A. Egg, enlarged X 8.

B. Larva, lateral aspect, enlarged X  $1\frac{1}{2}$ .

C. Pupa, lateral aspect, enlarged X  $1\frac{1}{2}$ .

Reproduced from painting by Charles M. Dammers

Henry Edwards states that eggs deposited on April 24th produced young larvae on May 5th. The newly emerged larvae are black, with very long hairs.

In southern California larvae are full grown in July and pupate shortly thereafter. They are nocturnal feeders. During the day they may be found among the leaves at the base of the tree or hidden in the crotches or old scars in the bark.

**MATURE LARVA:** Length, fully extended, 38 to 48 mm. Head, large; glistening dark brown, covered with short brown hairs. Ocelli, black. Mouth parts, colorless.

Body ground color, velvety brownish black, except for the abdominal area and prolegs, which are soiled yellow. The body is densely clothed with moderately long rich brown hairs grouped in a series of tufts. From each tuft there also arises one or two long chestnut hairs.

Each segment bears ten of these tufts, and an additional pair are also present in the mid-dorsal area on the third to eleventh segments. All tufts arise from dark brown tubercles.

Legs, chestnut. Crochets, brown. Spiracles, orange.

The mature larva is illustrated on Plate 23, fig. B.

Pupation occurs in debris at some distance from the site of feeding. A loosely woven pale yellow cocoon of tough texture is formed, into which the larval hairs are incorporated.

PUPA: Length, 22 mm., stout, and relatively short in proportion to its width. Cephalic end bluntly rounded; caudal end more acutely rounded. Color, chestnut, the ends of the antennal sheaths tinged with yellow. Spiracles, dark chocolate.

A few very short hairs arranged in pairs are sparsely distributed on the body. Plate 23, fig. C illustrates the pupa.

Imagines are on the wing in August and September. This would suggest the presence of a fall-winter brood, although we have no record of such an occurrence. The moth is pictured in colors on Plate X14, fig. 6 of Holland's "Moth Book." We illustrate it on the accompanying Plate 26, fig. A.

#### ABAGROTIS MIRABILIS GRT.

This moth was first described by Grote in the No. Amer. Entomologist, 1: 39, 1879, the type locality being given as Idaho Springs, Colorado. The species is apparently rare in California, but is common in parts of Utah. Dr. Smith (Cat. Noct. N. Am. p. 54) records it from Arizona and New Mexico. It is not mentioned in Holland's "Moth Book". Hampson treats it in Catalogue of the Lepidoptera Phalaenae, IV: 535, 1903, and includes a colored figure on Plate LXXVII, fig. 8, the latter being a slightly darker specimen than the typical insect. We figure the moth on our accompanying Plate 26, fig. C.

In April of 1934 the senior author collected two examples of the caterpillar in the Gavilan Hills, Riverside County, California, from *Juniperus californica* Carr. A drawing was made of the mature larva by the junior author which is reproduced on the accompanying Plate 24. It may be described as follows:

Length, fully extended, 32 mm., the body cylindrical and stout.

Head, pale olive-yellow, with brown mottlings or circlets on the cheeks, and a colorless patch in front. The black lines of the body extend onto a portion of the cheeks. Mouth parts, brown. Ocelli, black. A few short colorless hairs are present.

Body, ground color, ivory-white. A narrow longitudinal mid-dorsal soiled white stripe, edged with brown, runs the length of the body.

Subdorsally a longitudinal black band, margined infero-laterally with white is a conspicuous feature. This band breaks up

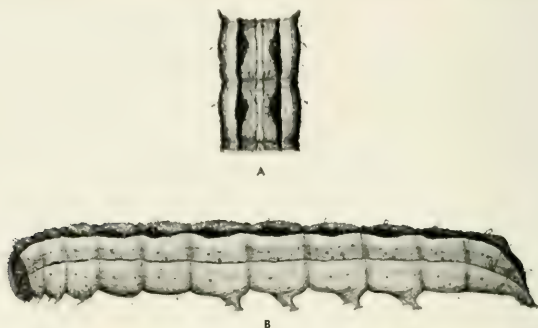


PLATE 24

Mature larva of *Abagrotis mirabilis* Grt.

- A. Typical segments of larva in dorsal aspect.
- B. Lateral view of larva. Figures enlarged approx. X 2.

Reproduced from painting by Charles M. Dammers

into olive-brown irregular spots along the inner margin of each segment, which gives the appearance of a dark triangular patch, the apex of the triangle pointing medially towards its fellow of the opposite side.

Inferior to this area is a broad band which is longitudinally striped with fine crenulated discontinuous olive brown lines. These tend to be slightly darker in the lower half of the band. This band terminates inferiorly at a narrow black longitudinal stripe, placed substigmatically. Along its lower margin this black stripe is edged with white.

The lower half of the body below the substigmatal line is striped with fine crenulated pale brown broken lines.

Spiracles, soiled white, with narrow black rims. Legs, colorless. Prolegs, colorless, the terminal pads pink, with brown crochets.

Each typical segment bears 12 short colorless setae, arising from black points.

Pupation took place under the soil late in April, and a single imago emerged June 10, 1934. This specimen is pictured on our Plate 26, fig. C.

#### FERALIA (MOMOPHANA) FEBRUALIS GRt.

One of the earliest moths to appear on the wing in California is the aptly named *Feralia februalis*. This handsome green noctuid

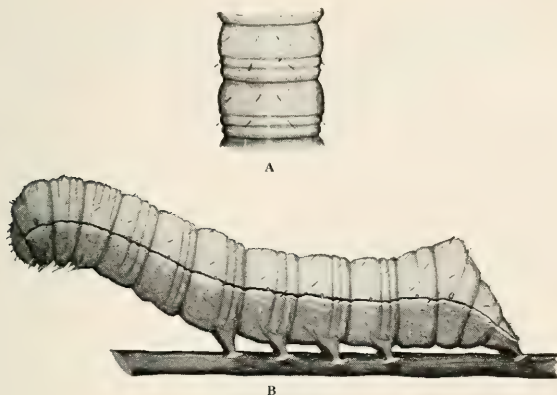


PLATE 25

Mature larva of *Feralia februalis* Grt.

- A. Typical segments, in dorsal aspect.  
 B. Larva, lateral aspect. Figures enlarged  $\times 2\frac{1}{4}$ .

Reproduced from painting by Charles M. Dammers

was first described by Grote in the Bulletin, Buffalo Soc. II: 60, 1874. He gave the type locality as Sansalito, which is a misspelling of Sausalito, the small Marin County town on San Francisco Bay.

Holland does not mention the species in the "Moth Book", but Sir George Hampson describes both sexes in Vol. VI, p. 200-201, Cat. Lep. Phalaenae, and illustrates it in colors on Pl. CI, fig. 15.

Three examples of the larvae were collected by the junior author on Feb. 24, 1935, in the Gavilan Hills, Riverside County, feeding on elderberry (*Sambucus glauca* Nutt.)

Mature larva: Length, extended, 29 mm. Cylindrical, stout, with a dorsal expansion or "hump" at the 10-11 segments.

Head: Considerably smaller than the first segment; pale apple green, the mouth parts tinged with brown, and with a white bar above them. Ocelli, black. A few short brown hairs occur on the head.

Body: Ground color, pale blue-green. Skin texture, smooth.

A narrow white mid-dorsal stripe runs the length of the body, and a still narrower broken longitudinal stripe (or series of dashes) occurs dorso-laterally.

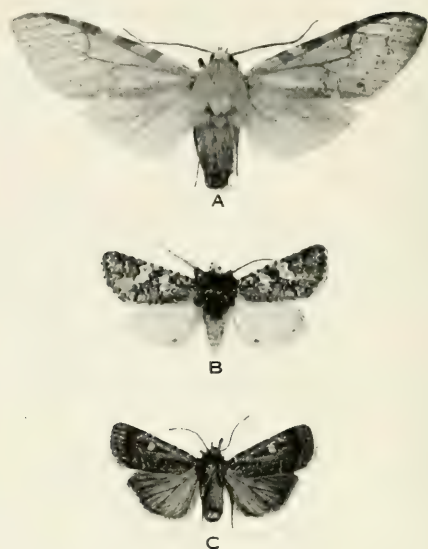


PLATE 26

- A. *Hemihyalea edwardsii* Pack. ♀ Paso Robles, Cal. Oct. 8, 1937.  
Coll. V. L. Clemence.
- B. *Feralia februalis* Grt. ♂ Glendale, Cal. March 27, 1927.
- C. *Abagrotis mirabilis* Grt. ♂ the Gavilan Hills, Riverside Co., Cal.  
June 10, 1934. Reared by C. M. Dammers.

All figures 4/5 natural size.

Stigmata there is a conspicuous but narrow orange-red band, margined inferiorly with white. In one example this band was dark red.

Abdominal surface, apple green, sparingly marked with soiled white dots and dashes.

Legs, pale brown, the terminal segments darker. Prolegs, pale apple green, the terminal pads flesh colored, with brown crochets.

Spiracles, soiled yellow with brown rims.

Each typical segment bears 12 short brown setae which arise from white dots.

A larva which went into pupation on March 5, 1935 gave forth an imago on January 1, 1936. Pupation occurs under the soil.

The mature larva is illustrated on Plate 25, and the imago on Plate 26, fig. B.



FURTHER REPORT ON A CHIGOE-LIKE FLEA  
FROM CALIFORNIA,

with a

DISCUSSION OF THE TRUE CHIGOE, *TUNGA*  
*PENETRANS* (Linn.)<sup>1</sup>GUSTAF F. AUGUSTSON<sup>2</sup>

In the spring of 1942 the writer received a small number of fleas for identification which he originally diagnosed as *Tunga penetrans* (Linn.) (Science, 1942). Specimens of this series were sent to another siphonapterist, and the error in identification was soon discovered. Recognition of this error was published by the writer (1943), but at that time the specific identification was still in doubt. Subsequent research has now established the identity of these fleas as *Hectopsylla psittaci* Fraunfeld.

These chigoe-like fleas constitute a new member to the known flea fauna of the Continental United States. Their discovery on a native bird (Pacific horned owl), in a well engorged condition, raises the question of the possibility of exotic species of parasites becoming established after introduction into this country. If such is true of this flea, so might it be for others, which may have a known history of economic importance elsewhere. The possibility, for instance, of *Tunga penetrans*, the chigoe, being introduced does not seem far fetched. Other writers have expressed a similar opinion, which is of interest to review here.

Baker suggested the finding of *Tunga penetrans* in the United States, and stated (1904, p. 374), "there is no authentic record of its occurrence within the borders of the United States though it may be expected in Florida and southern Texas." Another note of importance is given by C. Fox (1925, p. 130), who records, "this is a flea of tropical and subtropical America and has been introduced into Africa." Ewing (1929) discussed some of its taxonomic features, but does not consider distribution. In 1940 I. Fox (p. 12) quoted Baker (1c) adding, "no authentic record . . . has yet been made known." Faust and Maxwell (1930) had reported on an infection of a man in New Orleans in which many larvae were obtained from skin scrapings. I. Fox (1c) neglected to include this record. The source of infection in the case reported by Faust and Maxwell, however, was undoubtedly from cargoes of sisal hemp from Yucatan, as the patient gave a history of having sat on these piles of sisal. This record, then, is perhaps only of clinical interest rather than distributional.

<sup>1</sup>Done in part at the Allan Hancock Foundation, University of Southern California, and the Eighth Service Command Laboratory, Fort Sam Houston, Texas.

<sup>2</sup>1st Lieutenant, Sanitary Corps, Army United States, Entomologist.

Manson-Bahr (1940) gives the northern and southern limits of *Tunga penetrans* of 30° N. to 30° S.; this statement is probably accredited to the record of Faust and Maxwell (1c) as far as this area is concerned in the United States.

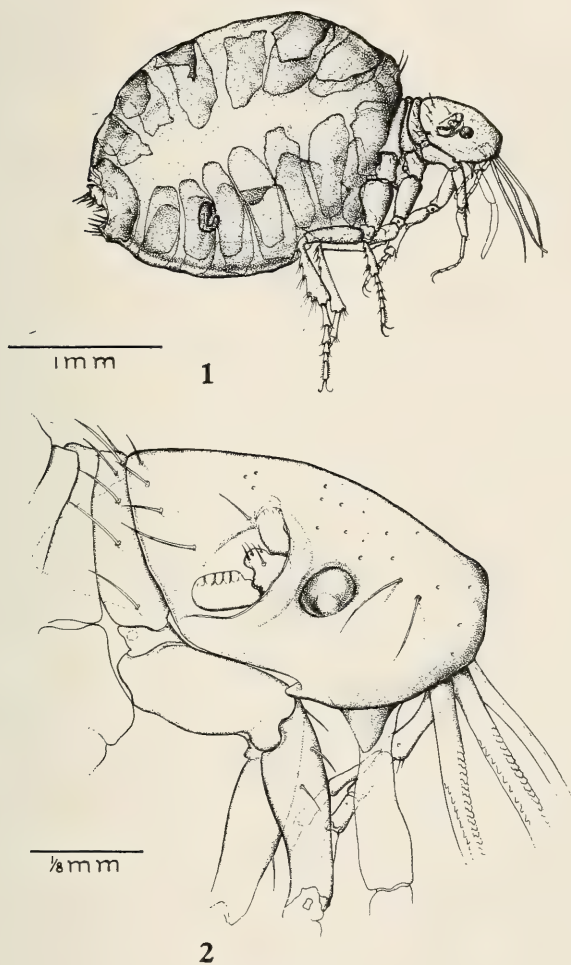
Ewing and Fox (1943) have recently published an account of *Tunga penetrans*, giving a description of the genus and a review of the life history of the species. They also record that it has been reported from Florida, Louisiana, and Texas. On the same page (p. 122) the Florida record was shown to be in error, the Louisiana that of Faust and Maxwell (1c), but gave no reference to the Texas record. Also of recent issue, with an excellent list of synonyms, is the paper by Jellison and Good (1942).

The extension that would follow the introduction of such an important parasite as *Tunga penetrans* into a given area, particularly during the present emergency, could reach great economic proportions. With the lowering of geographical barriers by aviation, and other modern methods of transportation, means of restricting the introduction of such parasites is a problem which should be given a great deal of attention.

The illustrations included, drawn by Anker Petersen, staff artist, Allan Hancock Foundation, under the writer's supervision, are added for convenience in the identification of *Hectopsylla psittaci* Fraun. There are no American publications with available plates of taxonomic value. Of interest to note is the general similarity of this flea to *Tunga penetrans*, particularly in the mouth parts, and well separated abdominal tergites and sternites, but differing, among other things, in the absence of a prominent angle to the frons, and the lack of a spur on coxa III.

#### REFERENCES

- Augustson, G. F., 1942. The Tropical chigoe in California, *Science* 96 (2504): 581.
- Augustson, G. F., 1943. Preliminary records and discussions on some species of siphonaptera from the Pacific Southwest. *Bull. So. Calif. Acad. Sci.* 42 (2): 69-89.
- Baker, C. F., 1904. A revision of American siphonaptera, or fleas, together with a complete list and bibliography of the group. *Proc. U. S. Nat. Mus.* 27: 365-469.
- Ewing, H. E., 1929. A manual of external parasites. C. C. Thomas Pub., Baltimore, Maryland, pp. 1-225.
- Ewing, H. E. and Fox, I., 1943. The fleas of North America, U. S. Dept. Agric. Misc. Pub. 500: 1-143.
- Fox, Carroll, 1925. Insects and disease of man. P. Blakiston's Son and Co., Phil. pp. 1-349.
- Fox, Irving, 1940. Fleas of Eastern United States. The Iowa State Coll. Press. pp. 1-191.
- Jellison, W. L. and Good, N. E., 1942. Index to the literature of siphonaptera of North America. *Nat. Inst. Health Bull.* 178.
- Manson-Bahr, P. H., 1940. Manson's tropical diseases. Eleventh Edition, Williams and Wilkins Co.



## PLATE 27

Fig. 1. *Hectopsylla psittaci* Fraun., female.Fig. 2. *Hectopsylla psittaci* Fraun., female, head enlarged.

## SOME BUTTERFLIES OF SEQUOIA NATIONAL PARK

By T. B. AND H. M. BLEVINS

Although Sequoia National Park lies athwart the Sierra Nevada Mountains in a position admirably situated for butterfly collecting, it is virtually virgin territory. This is due to a policy of the National Park Service that closes this park to collectors of any kind except accredited representatives of museums, universities or other organizations that will place the specimens on public display or use them for educational purposes.

In July of 1943 the authors were privileged to visit the park and to collect some representative series of butterflies for educational display. Due to the rationing of gasoline and to lack of time, we were unable to collect throughout all of the park, but we were fortunate enough to visit many desirable locations.

The lush green alpine meadows yielded bountiful catches of blues and Argynnis. Wherever the mountain sun-flowers grew, *Argynnis hydaspe*, *A. zerene monticola*, *A. henneli*, *A. motivaga*, and *A. mormonia* were sure to be found. At elevations of 6500 to 7500 feet, *A. hydaspe*, *A. monticola*, and *A. henneli* predominated. Higher elevations produced mostly *A. motivaga* and *A. mormonia*. *Brenthis epithore* is also a denizen of these upland meadows. The blues, on the other hand, scorned the more showy sun-flowers and chose as their home the lowly meadow grasses and the small, shy blossoms hidden therein. *Plebeius melissa lotis* were present in literally thousands. *Plebeius icarioides* and *P. aquilo podarce*, while scarce by comparison, were also fairly common. Once in a while a fortuitous netting would yield *Phaedrotus piasus* or *Plebeius lupini*. The latter usually were found at higher elevations. *Plebeius anna* is also reported from the park by Mr. Lloyd M. Martin of the Los Angeles Museum.

Papilionidae were represented wherever the mountain thistles are in bloom by *Papilio euzymedon*, *P. rutulus* and *P. zelicaon*. An occasional specimen of *P. indra* was also to be found. At elevations of 8000 feet or greater *Parnassius clodius baldur* would sometimes be encountered. They were at their greatest abundance on Alta Peak, in Elizabeth Pass, and above the Kern river near the foot of Mt. Whitney. They seem to take a fiendish delight in flaunting their gossamer wings over some rocky precipice that is completely out of reach of anything less than a helicopter, but occasionally they make a fleeting trip to some neighboring meadow, enabling a collector to take a fair series if he has sufficient patience.

In late July and early August *Neophasia menapia* appears in the neighborhood of Crystal Caverns at an elevation of about 5000

feet. As always they spend most of their time circling their beloved pine-trees, but can occasionally be lured within reach by a scrap of white paper, as Dr. J. A. Comstock suggests in his "Butterflies of California". They are never very common in this region.

*Eucloe ausonides coloradensis* is a rarity in the park, but sometimes is found along the Kern river above Mineral King.

*Melitaea hoffmanni*, *M. palla whitneyi*, *Euphydryas irelandi*, *E. nubigena*, and *E. sierra* are not common, but can be taken on the upper slopes of Alta Peak and other high mountains in the park. They often seek the nectar of the wild sun-flowers that grow around the icy mountain springs that burst forth on these upper slopes. *Melitaea leanira* is sometimes encountered near Crystal Caverns. *Phyciodes campestris* and *P. mylitta* also frequent the emerald meadows.

Hairstreaks are not overly common, but when found are often desirable specimens. *Mitoura spinetorum*, *M. nelsoni*, *Incisalia eryphon*, *I. iroides*, *Atlides halesus*, *Habrodais grunus*, and *Strymon saepium* constitute the hairstreak population. They are usually found between 5000 and 7000 feet and often are associated with a bush composite or with the sun-flowers.

Coppers are also uncommon, but they too present a good variety. *Lycaena nivalis*, *L. heteronea* and *L. editha* seek the alpine meadows, while *L. helloides* is to be found around Crystal Caverns. An occasional specimen of *L. cupreus* straggles into the Elizabeth Pass region, but this appears to be a visitor, rather than a permanent resident.

Hesperioidea are but poorly represented in Sequoia. *Polites sonora* is the only skipper to be found in quantity. *Hesperia harpalus*, *H. harpalus leussleri*, *H. nevada*, *Ochlodes sylvanoides*, *Polites sabuleti tecumseh*, *Thorybes nevada* and *Pyrgus ruralis* are also to be found, but they are rare. Without exception they seek the higher elevations.

The following more common species were observed or taken at various places in the park: *Vanessa virginiensis*, *V. cardui*, *V. carye*, *Colias eurytheme*, *Pieris rapae*, *Strymon melinus*, *Plcbeius acmon*, *Danaus plexippus*, *Coccyonympha californica*, *Heterochroa bredowii californica*, *Basilarchia lorquini*, and *Lycacnopsis pseudargiolus echo*.

This is necessarily an incomplete coverage since it embraces only one month out of the four months that collecting is possible at Sequoia and it only covers a portion of the park. However, it is the hope of the authors that this may help to shed some light on a region of California that is at present only poorly represented in collections. The specimens named in this paper have all been compared to authenticated specimens. The nomenclature is after the 1937 check-list of Dr. J. McDunnough.



# BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California  
Subscription—\$2.00 per year

Free to Life Members and Unlimited Annual Members  
of the Academy (Annual Membership Fee \$5.00)

*Address all communications to* DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,  
Los Angeles 7, Calif., U. S. A.

---

## PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

## Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1944, including volumes XXIV to XLIII, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

### MEMOIRS

Vol. 1, 1938. Vol. 2, Part 1, 1939. Vol. 2, Part 2, 1944.

# PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

*For Sale at the Appended Prices*

## BULLETIN:

	To Members	To Non- Members
Complete set, Vols. 1 to 39, bound .....		\$115.00
(Incomplete set) Vols. 8 to 33, bound .....		80.00
Vol. 3, No. 7, 1904 .....	\$ .25	.50
" 4, " 5, 1905 .....	.25	.50
" 6, " 1, 1907 (Photostat only) .....	2.00	4.00
" 6, " 2, 1907 .....	.25	.50
" 7, " 1, 1908 .....	1.00	2.00
" 8, " 1, 1909 .....	1.00	2.00
" 9, " 1, 1910 .....	2.00	4.00
" 9, " 2, 1910 .....	.75	1.50
" 10, " 1, 1911 .....	1.00	2.00
" 10, " 2, 1911 .....	2.00	4.00
" 11, " 2, 1912 .....	1.00	2.00
" 12, " 1, 1913 .....	1.00	2.00
" 15, " 2, 1916 .....	.75	1.50
" 16, " 2, 1917 .....	1.00	2.00
" 17, " 1, 1918 .....	2.00	4.00
" 17, " 2, 1918 .....	1.50	3.00
" 18, " 2, 1919 .....	2.00	4.00
" 19, " 1, 1920 .....	.50	1.00
" 19, " 4, 1920 .....	.50	1.00
" 20, " 1, 1921 .....	2.00	4.00
" 20, " 2, 1921 .....	2.00	4.00
" 20, " 3, 1921 .....	2.00	4.00
" 21, " 1, 1922 .....	2.00	4.00
" 21, " 2, 1922 .....	1.00	2.00
" 22, " 1, 1923 .....	1.50	3.00
" 22, " 2, 1923 .....	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each) .....	.25	.50
" 24, " 1, 2, 3, 1925 (each) .....	.25	.50
" 25, " 2, 3, 1926 (each) .....	.25	.50
" 26, " 1, 2, 3, 1927 (each) .....	.25	.50
" 27, " 1, 2, 3, 1928 (each) .....	.25	.50
" 28, " 1, 2, 3, 1929 (each) .....	.25	.50
" 29, " 1, 2, 3, 1930 (each) .....	.25	.50
" 30, " 1, 2, 3, 1931 (each) .....	.25	.50
" 31, " 1, 2, 3, 1932 (each) .....	.25	.50
" 32, " 1, 2, 3, 1933 (each) .....	.25	.50
" 33, " 1, 2, 3, 1934 (each) .....	.25	.50
" 34, " 1, 2, 3, 1935 (each) .....	.25	.50
" 35, " 1, 2, 3, 1936 (each) .....	.25	.50
" 36, " 1, 2, 3, 1937 (each) .....	.25	.50
" 37, " 1, 2, 3, 1938 (each) .....	.25	.50
" 38, " 1, 2, 3, 1939 (each) .....	.25	.50
" 39, " 1, 2, 3, 1940 (each) .....	.25	.50
" 40, " 1, 2, 3, 1941 (each) .....	.25	.50
" 41, " 1, 2, 3, 1942 (each) .....	.25	.50
" 42, " 1, 2, 3, 1943 (each) .....	.25	.50
" 43, " 1, 2, 3, 1944 (each) .....	.25	.50

*(Continued on next page)*

# PUBLICATIONS (*continued*)

## MEMOIRS:

	To Members	To Non- Members
Vol. 1, 1938—paper cover .....	\$2.00	\$4.00
“ “ “ bound in black fabrikoid .....	3.00	5.00
“ “ “ printed on one side of paper .....	3.00	5.00
“ “ “ printed on one side of page (bound) .....	4.00	6.00
Vol. 2, No. 1, 1939—paper cover .....	1.25	2.50
“ “ “ “ bound in black fabricoid ....	2.25	3.50
“ “ “ “ printed on one side of page .	1.75	3.50
“ “ “ 2, 1944—paper cover .....	.75	1.50

## Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published) ...bound	\$1.50, unbound	\$1.00
Southern California Geology and Los Angeles Earthquakes, R. T. Hill .....	bound	5.00
Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate .....		1.00
Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall .....		1.00

## Reprints:

Check-list of the Lepidoptera of Boreal America. Superfami- lies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .....		\$ .50
The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .....		.25
Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, \$1.50. To non- members .....		3.00
A List of the ANTS OF CALIFORNIA with notes on their habits and distribution. 44 pages, 3 plates, by Arnold Mallis		.50

ADDRESS ALL INQUIRIES TO  
SOUTHERN CALIFORNIA ACADEMY OF SCIENCES  
(Care DR. JOHN A. COMSTOCK)  
Los Angeles Museum, Exposition Park,  
Los Angeles 7, Calif., U. S. A.

# Bulletin, Southern California Academy of Sciences

Vol. XLIII, 1944

## INDEX OF SUBJECTS

- |  |        |   |     |
|--|--------|---|-----|
| A Crystallized Millipede from Volcanic Rock in a Well.....     | 18     | <i>Hectopsylla psittaci</i> Fraunfeld.....  | 119 |
| <i>Abagrotis mirabilis</i> Grt.....                            | 115    | <i>Hemihyalea edwardsii</i> Pack.....   | 113 |
| <i>Archanara alameda</i> Smith.....                            | 81     | <i>Hydriomena crokeri</i> Swett.....  | 26  |
| <i>Archanara oblonga</i> Grt.....                              | 81     | <i>Hydriomena crokeri comstocki</i> McD. ....   | 27  |
| <i>Arzama gargantua</i> Dyar.....                              | 82, 84 | <i>Hydriomena glaucata</i> Pack.....  | 24  |
| Avian Fossil Records from California, Miscellaneous .....      | 74     | Hydriomena Studies .....  | 23  |
| <i>Bembidion davidae</i> Pierce.....                           | 7      | <i>Hypoglossum retusum</i> Dawson   | 107 |
| <i>Bembidion everestae</i> Pierce.....                         | 11     | Land Slugs in California.....   | 33  |
| <i>Binghamiella Forkii</i> Dawson.....                         | 96     | Larva and Pupa of <i>Arzama gargantua</i> Dyar .....  | 84  |
| Brief Notes on the Early Stages of Three California Moths..... | 113    | <i>Laurencia Snyderae</i> nom. nov....  | 98  |
| <i>Californibolus</i> Verhoeff .....                           | 53     | <i>Leptofaucha pacifica</i> Dawson..  | 104 |
| <i>Californibolus michelbacheri</i> Verhoeff .....             | 56     | Lower Miocene Fossil Carabid Beetle, Description of.....  | 4   |
| <i>Californiulidae</i> Verhoeff .....                          | 59     | Marine Algae, Notes on Pacific Coast .....  | 95  |
| <i>Californiulus</i> Verhoeff .....                            | 61     | <i>Melanella rosa</i> Willett.....  | 72  |
| <i>Californiulus dorsovittatus</i> Verhoeff .....              | 62     | New Species of Mollusks from Redondo, California .....  | 71  |
| <i>Cardita hilli</i> Willett.....                              | 19     | Notes on the Food of Reptiles with Special Reference to their Possible Control of Cone-nosed Bugs ..... | 86  |
| <i>Chilognatha</i> , Some Californian .....                    | 53     | Notes on the Immature Stages of <i>Urbanus tessellata occidentalis</i> Sk. ....                         | 30  |
| <i>Chione picta</i> Dall.....                                  | 21     | Notes on Pacific Coast Marine Algae. II .....   | 95  |
| Coleopterous Elytra, Discussion of.....                        | 4      | <i>Nucula burchi</i> Willett.....   | 71  |
| Collecting and Preserving Land Slugs.....                      | 41     | <i>Pachydesmus cummingsiensis</i> Verhoeff .....  | 66  |
| Deep Well Lower Miocene Carabid Beetle, Description of a ..... | 10     | Pelecypods, Two New West American .....   | 19  |
| Entomophobia .....   | 78     | <i>Philine californica</i> Willett.....   | 72  |
| <i>Exaeretoptera</i> Pierce.....                               | 15     | <i>Polycoryne phycodricola</i> Dawson .....   | 108 |
| <i>Exaeretoptera fosteri</i> Pierce.....                       | 15     | <i>Protosegestes</i> Pierce .....   | 13  |
| <i>Feralia februalis</i> Grt.....                              | 117    | <i>Protosegestes lloydi</i> Pierce.....   | 13  |
| Fossil Arthropods of California .....                          | 1      |   |     |
| Four California Moths Associated with Cat-tails .....          | 81     |   |     |
| Further Report on a Chigoe-like Flea from California.....      | 119    |   |     |





Reptile Associates of Wood	Some New and Unreported
Rats and Cone-nosed Bugs,	Sublittoral Algae from Cer-
The ..... 44	ros Island, Mexico..... 102
<b>Sciadophycus</b> Dawson ..... 105	<i>Tunga penetrans</i> (Linn.)..... 119
<b>Sciadophycus stellatus</b> Dawson 105	Two Interesting Orthopteroids
<b>Scinaia minima</b> Dawson..... 103	from Diatomaceous Deposits 12
Sequoia National Park, Some	Two New West American Pel-
Butterflies of ..... 122	ecypods ..... 19
<i>Simyra henrici</i> Grt..... 81	<i>Urbanus tessellata occidentalis</i>
Some California Chilognatha... 53	Sk. .... 32
	<b><i>Volvulella tenuissima</i></b> Willett... 71

New varieties and species indicated in bold face type

# INDEX OF AUTHORS

Augustson, Gustaf F..... 119	Gregg, Wendell O..... 41
Blevins, T. B. and H. M..... 122	Howard, Hildegard ..... 74
Comstock, John A..... 81	Lange, W. H., Jr..... 33
Comstock, J. A. and Dammers,	McDunnough, J. H..... 23
Charles M. ....84, 113	Pierce, W. Dwight.....1, 78
Dawson, E. Yale.....95, 102	Verhoeff, K. W..... 53
Dethier, V. G..... 30	Willett, George ..... 19
	Wood, Sherwin F.....44, 71, 86



**REPRINTS:** Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

## PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies .....	\$3.75	\$ 5.75	\$ 8.50	\$10.25	\$11.75	\$13.50	\$16.00	\$17.00
100 " .....	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 " .....	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 " .....	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 " .....	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 " .....	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

**Covers:** 50 for \$2.00—additional covers 1½c each.

California State Sales Tax to be added if delivered within the state.



*Distinctive*

# PRINTING

Books • Catalogs • Broadsides  
Stationery and Office Forms



## McBRIDE PRINTING CO.

PHONE: PROspect 2045  
415 EAST ELEVENTH ST.  
Los Angeles 15, Calif.

*"Since 1879"*

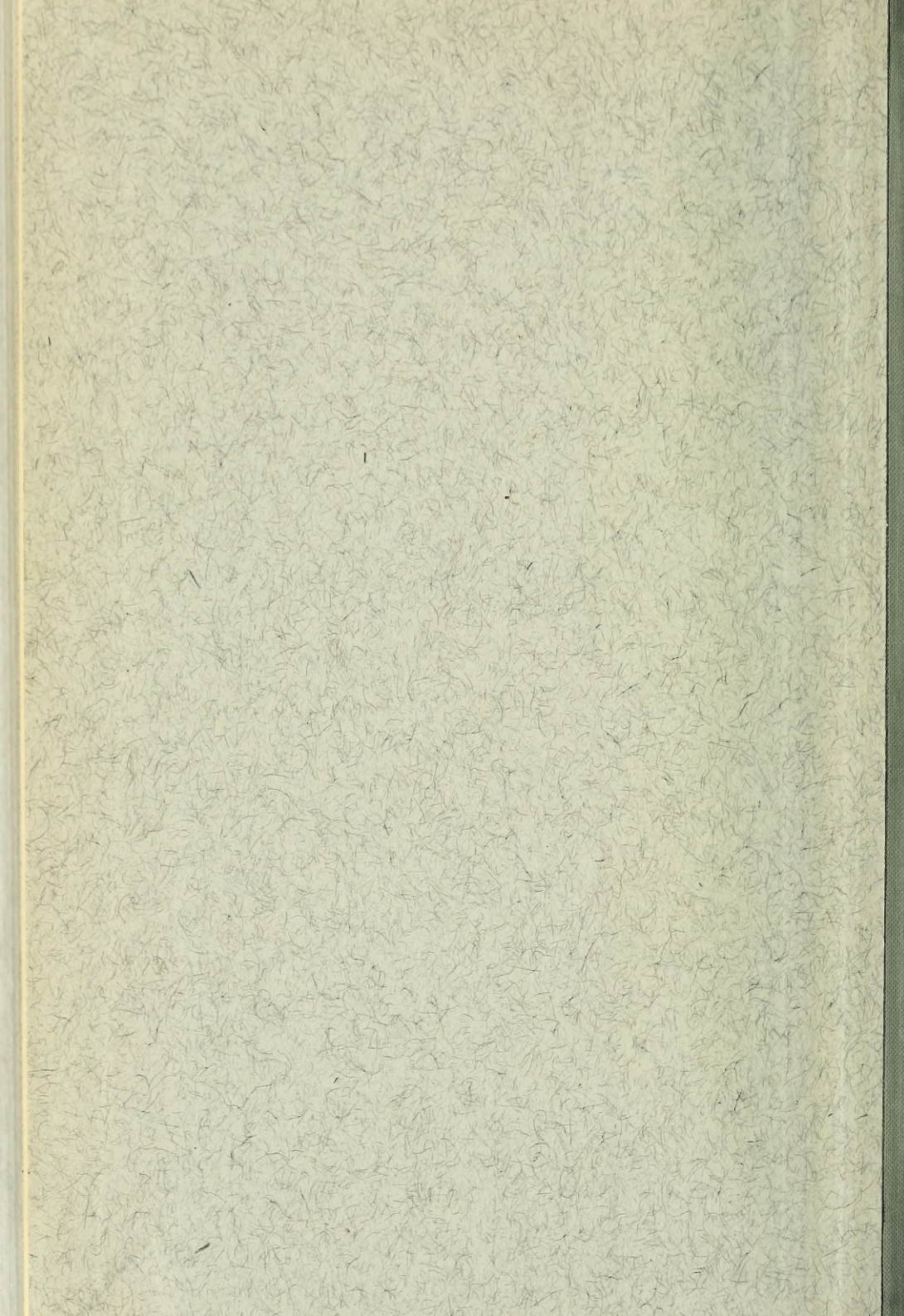
2:13  
over















3 5185 00296 8194



